



312066 0278 1224 3

U OF MASS/AMHERST LIBRARY
FINAL

ENVIRONMENTAL IMPACT REPORT

FOR THE

SNOW & ICE CONTROL PROGRAM

OF THE

Massachusetts Department of Public Works
Metropolitan District Commission
Massachusetts Bay Transit Authority
Massachusetts Turnpike Authority

July 1978

Prepared By: Massachusetts Department of Public Works

789/58

TABLE OF CONTENTS

I.	SUMMARY AND ORGANIZATION OF REPORT	I-1
II.	CONCLUSIONS AND RECOMMENDATIONS	II-3
III.	EXPERIENCES	III-7
	A. Winter of 1975 - 1976	III-7
	1) Test Sections	III-7
	B. Winter of 1976 - 1977	III-10
	1) Practices - 20% Reduction	III-10
	2) Sensitive Areas	III-19
	3) Sodium Standard	III-21
IV.	OPERATIONS	IV-25
	A. Equipment	IV-25
	1) Winter 1975- 1977, history	IV-25
	2) Winter 1977 - 1981, proposal	IV-28
	B. Maintenance Sites	IV-28
	1) Winter 1975 - 1977, history	IV-28
	2) Winter 1977 - 1981, proposal	IV-30
	C. Education	IV-31
	1) Winter 1975 - 1977, history	IV-31
	2) Winter 1977 - 1981, proposal	IV-32
	D. Budget	IV-33
	1) Winter 1975 - 1977, history	IV-33
	2) Winter 1977 - 1981, proposal	IV-35
V.	NEW TECHNIQUES	V-38
VI.	SENSITIVE SITES	VI-40
VII.	COST BENEFITS	VII-54
	A. Benefits - Quantifiable	VII-61
	B. Benefits - Quantifiable When Documented	VII-64
	C. Benefits - Not Quantifiable	VII-67
	D. Costs - Quantifiable	VII-68
	E. Costs - Quantifiable When Documented	VII-72
	F. Costs - Not Quantifiable	VII-73
	G. Conclusions	VII-74
VIII.	PARTICIPATION	VIII-77
	A. Task Force	VIII-77
	B. Public Hearing	VIII-82
	C. Other	VIII-84
IX.	CITIES AND TOWNS	IX-86
X.	COMMENTS ON THE DRAFT E.I.R. AND RESPONSES	X-88



Digitized by the Internet Archive
in 2014

<https://archive.org/details/finalenvironment00mass>

I. SUMMARY AND ORGANIZATION OF REPORT

This Final Environmental Impact Report was prepared and is being circulated in response to the Massachusetts Environmental Policy Act and the Rules and Regulations for the Preparation of Environmental Impact Reports of the Executive Office of Transportation and Construction. The report is also available upon request. Unlike most final environmental impact reports which are basically draft environmental impact reports updated in response to comments by the Secretary of Environmental Affairs and other agencies this report was developed separate from the draft environmental impact report. However, the comments submitted by the Secretary of Environmental Affairs and other State agencies along with the responses are contained in Section X of this report. A summary of comments made by other organizations and individuals is also contained in Section X.

This Final Environmental Impact Report is a dynamic document and there will be an annual update report for the next four years which will be consolidated and developed into an environmental impact report in 1981. The Executive Office of Environmental Affairs approved this approach.

This Report summarizes experiences and operations for the past two winter seasons and discusses proposed operations for the 1977-1981 winter seasons. Other subjects also discussed are; new techniques, sensitive sites, benefit-cost analysis, agency participation and involvement of cities and towns.

The organization of this Final Environmental Impact Report is outlined in the table of contents.

I. SUMMARY AND ORGANIZATION OF REPORT (Cont'd)

The information in reference to the Massachusetts Turnpike Authority, Metropolitan District Commission, and Massachusetts Bay Transportation Authority, was supplied by those agencies in response to a specific request for the needed information from the Massachusetts Department of Public Works for use in this report. The Massachusetts Department of Public Works prepared this final report.

11. CONCLUSIONS AND RECOMMENDATIONS

1. The Department (DPW) will continue literature research on snow and ice removal using deicing chemicals and/or innovative equipment. Findings, wherever applicable, will be made available to all agencies concerned with this activity for possible implementation.
2. State agencies will continue to report deicing chemical usage on an annual basis after each winter season. The reporting process should be expanded to gather and compile data from municipalities and other large industrial and private organizations using deicing chemicals for snow and ice removal.
3. The Department will study the chemical treatment and monitoring of designated sensitive sites each winter season. A determination will be made, after careful evaluation, of the contribution of deicing chemicals to the sodium content of the water supplies from the field records compiled. Additional sensitive sites will be selected whenever sodium test results on water supplies indicate sodium concentration levels greater than acceptable standards.

11. CONCLUSIONS AND RECOMMENDATIONS (CONT.)

Test results shall be widely distributed to all agencies concerned with the use of the water supplies affected. Studies will be conducted and recommendations made for installation of closed drainage systems wherever feasible for sensitive sites, if this approach will help to minimize sodium contamination.

4. State agencies will strive towards reducing salting policies by using fixed and recommended salt application rates while decreasing the number of applications. As a check on effectiveness of the method selected, at the end of each winter season, the value of "Tons of Salt Per Lane Mile Per inch of Snow" shall be calculated. Such information would be available to the Department for use in upgrading snow and ice reports and evaluating the results.
5. The Department will request budget allocation to effect the goal of 100% automation of both hired and state owned spreaders within a reasonable time frame. This modernization policy shall be recommended to other state agencies and municipalities responsible for application of ice-melting chemicals in snow and ice removal.

11. CONCLUSIONS AND RECOMMENDATIONS (CONT.)

6. The Department will take steps to store all salt under cover or in storage sheds and shall encourage other state agencies and municipalities to do likewise. When budget allocation allows, the Department will make funds available to all municipalities requesting salt storage sheds for construction, where water supplies indicate sodium contamination above 20 parts per million. The purpose in this program is to effect a minimum of salt contamination of water wells and water supply sources due to run-off from salt storage piles left uncovered.
7. The Department will continue with the training programs for personnel assigned to snow removal equipment and extend the policy to include other state agencies and municipalities. In this manner it will be possible to stress close monitoring of salt spreading with techniques that lay down a minimum of the ice melting chemicals.
8. Benefits and costs shown in the summary, "Quantifiable When Properly Documented", will be given dollar values in upgrading future reports as the methodology advances to make this possible.

11. CONCLUSIONS AND RECOMMENDATIONS (CONT.)

9. The Snow and Ice Task Force will be assembled from time to time to gather input and discuss progress in implementing the reduced salting policy.
10. The Department through its Snow and Ice Control Media Campaign will in advance of predicted snow storms, urge the public to stay off the highways and drive only if essential. Plowing can be increased where highways are free of traffic and a minimum use of salt applied. Motorists will be urged to adjust their driving speeds with respect to existing road conditions.

III EXPERIENCES

III A. Winter of 1975-1976

I. Test Sections

In the fall of 1975, at the direction of the Commissioner of the Massachusetts Department of Public Works, preparations were made for implementing tests on the effectiveness of reduced application rates of salt on certain sections of State highway. Originally, seven test sections were proposed one for each district, except District 8. As a result of public opposition expressed at public meetings conducted in each of the areas three of the test sections were eliminated. For the four remaining sections, two were treated with a rate of 100 pounds per lane mile per application and two were treated with a rate of 200 lbs. per lane mile per application. For each of the test sections there was a control section which was treated with the statewide rate of 300 lbs. per lane mile per application. All test and control sections were closely monitored.

The results on the test sections using an application rate of 100 lbs./L.M./appl. demonstrated that a greater quantity of total chemicals were used than on the 200 lbs./L.M./appl. test sections and the control sections. Also, to maintain a consistent standard of maintenance, more re-applications of chemical were required, thus increasing labor and equipment costs.

In reference to the test sections which received the application rate of 200 lbs./L.M./appl., the higher application rate with the corresponding lower number of applications proved more cost beneficial than the application rate of 100 lbs./L.M./appl. If the Department of

III A.1. (Cont.)

Public Works were to treat Statewide at the 200 pound rate there would be a reduction of .75 tons of salt per lane mile per year. This represents a potential savings in salt of \$125,000 (.75 tons x 11,500 L.M. x \$14.50 per ton); however, this must be considered against the possible increase in spreader cost of \$1,000,000 (135 spreaders x 300 hours x \$25.00 per hour) without taking into consideration the public inconvenience and safety factors. Although no additional spreaders would be needed, more hours per spreader to accomplish additional trips would be required, to provide comparable results.

As mentioned previously, for each test section there was a similar control section. The control sections were treated with the Statewide application rate of 300 lbs./L.M./appl. and due to the close supervision received a limited number of applications. This combination of application rate with a limited number of applications, only as needed, achieved the optimum condition within the context of the test program.

The results of these tests confirm the Department's contention that the "application rate and number of applications together determines the total winter's usage of deicing chemicals. With an application rate that is reasonable emphasis has to be on the number of applications and elimination of the needless". (1) With an optimum application rate and a longer period of time between applications less chemical usage will be achieved. A decrease below this optimum rate will require more frequent applications, allow for the possible formation of pack and result in a decreased highway utility.

III A.1. Cont.

The complete "Report on the Test and Control Sections", which was prepared by the Maintenance Section of the Massachusetts Department of Public Works was distributed as an addendum to the Draft Environmental Impact Report. (4)

Due to a shortage of manpower and equipment, test sections were not set up by the Metropolitan District Commission. Test sections also were not set up by either the Massachusetts Turnpike Authority or the Massachusetts Bay Transportation Authority.

III B. Winter 1976-1977

I. Practices

In November of 1976 Commissioners John J. Carroll of the Massachusetts Department of Public Works and Secretary Evelyn F. Murphy of the Executive Office of Environmental Affairs jointly announced a Statewide Snow and Ice Control Policy for the Winter Season of 1976-77. A major reduction in salt usage was to be obtained without jeopardizing the level of service necessary to sustain the economic requirements for a smooth flow of goods and services.

This policy focused on a reduction of 20%, from the previous 5 year average, the total amount of deicing chemicals applied per lane mile for the entire winter, while taking into account the relative severity of storm conditions. The graph in figure III-1 was developed in the formulation and evaluation of this planned 20% reduction.

The following measures were implemented in an effort to achieve this goal:

- A reduction in the frequency of applications at 300 pounds per lane mile to the minimum number of applications, absolutely necessary.
- Closer monitoring and regulation of deicing chemical applications.
- Increased emphasis on the treatment of ice sensitive areas such as bridge decks, steep grades, windswept areas, etc., with partial applications, as necessary, rather than overall general applications.
- Increased use of calibrated equipment and sensitive automated devices geared to achieve the prescribed application rate more effectively.

FIGURE III-1

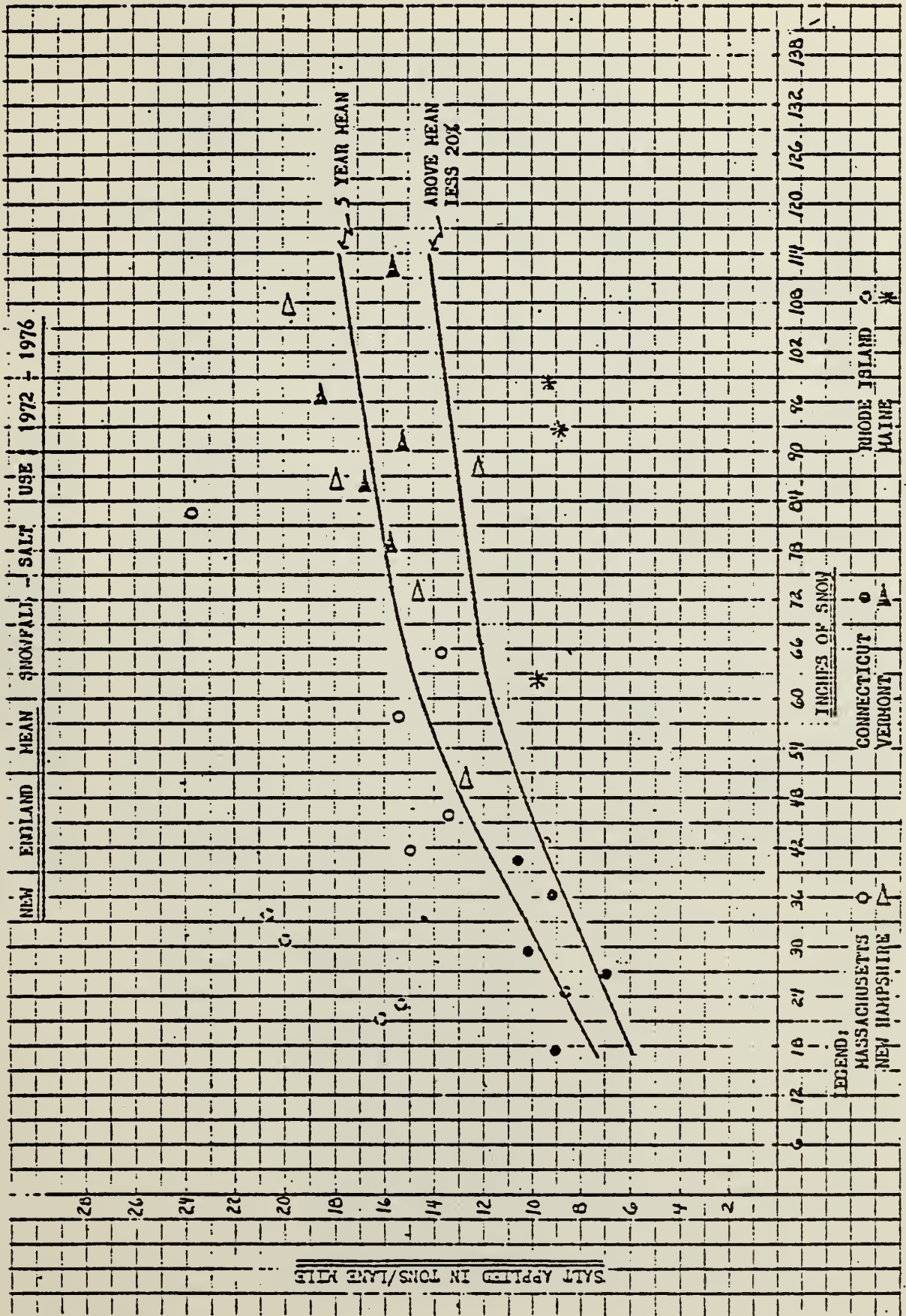


TABLE III-1
GRAPH COORDINATES

STATE	<u>Average Snowfall = Inches:</u>		<u>Salt Use = Tons Per Lane Mile</u>		
	1975-76	1974-75	1973-74	1972-73	1972-71
MASSACHUSETTS					
Snowfall	65.2	58.0	46.2	41.7	82.8
Use	13.7	15.5	13.5	15.0	23.7
NEW HAMPSHIRE					
Snowfall	86.9	73.2	50.3	88.4	107.2
Use	17.9	14.6	12.7	12.2	19.8
VERMONT					
Snowfall	96.7	91.2	78.4	85.9	112.1
Use	18.5	15.2	15.3	16.8	15.6
CONNECTICUT					
Snowfall	40.6	26.6	29.7	17.3	36.5
Use	10.7	7.0	10.3	9.1	9.3
RHODE ISLAND					
Snowfall	34.0	24.8	22.7	21.3	30.7
Use	20.7	8.6	15.3	16.1	20.0
MAINE					
Snowfall	98.3	92.7	62.3	---	---
Use	9.3	8.9	9.9	11.0	11.3

TABLE 111-3

MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

SALT USAGE

FISCAL YEAR	TONS	LANE MILES	TONS SALT LANE MILE	AVG. ACCUM. OF SNOW (IN.)	PRODUCTION*		TONS SALT PER LANE MILE PER INCH SNOW	POUNDS SALT PER LANE MI. PER IN. SNOW	% IMPROV. **
					SNOW ACCUM (IN.) PER TON SALT PER LANE MILE	PER TON SALT PER LANE MILE			
1973-74	153,389	11,438	13.4	46	3.43		.291	582.0	
1974-75	179,484	11,566	15.5	58	3.74		.267	534.0	8
1975-76	158,682	11,600	13.8	66	4.78		.209	418.2	22
1976-77	169,005	11,611	14.6	81	5.55		.180	360.5	14

*This column refers to the inches of snow treated per ton of salt per lane mile
As can be seen, in successive years, more snow was treated per ton of salt.

**Percent improvement over the previous fiscal year.

III B. 1. Cont.

- Continued field development of electronic devices for determining surface icing conditions.
- Intensification of the annual training program for field personnel in proper snow and ice control procedures.
- More stringent reporting and control procedures for the Department's eight districts.

With the implementation of the above measures the Massachusetts Department of Public Works was able to achieve a reduction of 14% in deicing chemicals usage for the winter of 1976-77 in comparison to the winter of 1975-76. (See Table III-3) It should be emphasized that inches of snow is an extremely unreliable parameter for comparing winters because the water content of various snowfalls differ considerably and does not take into account other variables such as temperatures, wind, radiational effects, rates of fall, traffic, etc. However, inches of snow is the most easily understood parameter as a basis of comparison (See Table III-3)

By conscientiously following the foregoing measures the Massachusetts Department of Public Works plans to continue the reduction of the use of deicing chemicals on the State's highway with lowest possible level consistent with highways that are reasonably safe for travel.

The Massachusetts Turnpike Authority, through an extensive training program and constant monitoring throughout storms, experienced a 29.4% reduction in total chemical use for the 1976-77 winter season as compared to the preceding 5-year average mean and a 27% reduction in total salt use over the previous 1975-76 winter season. (See Tables III-4, 5, 6, 7, and figure III-2)

TABLE III-4
MASSACHUSETTS TURNPIKE AUTHORITY
MAINTENANCE DEPARTMENT
COMPARISON OF TONS OF SALT USED 1970-71 thru 1976-77

DEPOT	1970 1971	1971 1972	1972 1973	1973 1974	1974 1975	1975 1976	1976 1977
Lee	6,614	5,970	4,576	3,370	5,091	4,959	3,873
Bland.	5,717	5,681	4,306	3,007	4,124	4,799	3,303
Chicopee	4,123	4,923	4,634	3,153	3,297	3,991	3,324
Warren	7,442	7,622	7,122	5,344	5,113	7,077	4,416
Auburn	3,523	3,157	6,271	4,737	5,237	6,432	4,721
Weston	5,095	4,375	3,779	3,001	2,942	4,202	2,870
Sub- Total	38,519	36,739	30,688	23,127	25,854	31,510	22,591
Boston Extension	5,497	3,245	3,340	3,647	3,566	4,515	3,737
Grand Total	44,016	41,984	34,028	26,774	29,420	36,025	26,328

TABLE III-5
MASSACHUSETTS TURNPIKE AUTHORITY
DEICING CHEMICAL USAGE 1969 - 1977

WINTER SEASON	SODIUM CHLORIDE TONS	CALC. CHLORIDE (FLAKE) TONS	CALC. CHLORIDE (3:1 MIX) TONS	SAND TONS
1969-1970	39,103	16	65	2,279
1970-1971	44,016	8	79	1,029
1971-1972	41,984	15	32	594
1972-1973	34,028	28	170	641
1973-1974	26,774	7	702	573
1974-1975	29,420	20	407	2,109
1975-1976	36,025	40	514	2,232
1976-1977	26,293	18	76	2,314

"The Massachusetts Turnpike's snow removal program encompasses a total of 1,100 lane (12") miles."

The Massachusetts Turnpike stretches 135.2 miles from the New York state line in the west to Kendall Street, Boston, in the east. It crosses thru the following cities and towns: West Stockbridge, Stockbridge, Lee, Becket, Otis, Blandford, Russell, Westfield, West Springfield, Chicopee, Ludlow, Wilbraham, Palmer, Springfield, Warren, Sturbridge, Charlton, Oxford, Auburn, Milbury, Grafton, Upton, Westborough, Hopedon, Southborough, Framingham, Natick, Wayland, Weston, Newton, Brookline and Boston.

TABLE III-6
MASSACHUSETTS TURNPIKE AUTHORITY
MAINTENANCE DEPARTMENT
SNOW AND ICE CONTROL CHEMICAL USE REPORT
1976-77

REPORT ON USE OF SAND & CHLORIDES- FISCAL YEAR 1977														DATE 5/18/77				
Section Lane Miles in	SAND & SALT				SODIUM CHLORIDE - 50% SOLID				SODIUM CHLORIDE - 100% SOLID				Post-Season Stockpile	Delivered	Applied	Post-Season Stockpile	AV. Number of Snow Storms	Total Depth in " of Snow
	Section	Delivered	Applied	Post-Season Stockpile	Section	Delivered	Applied	Post-Season Stockpile	Section	Delivered	Applied	Post-Season Stockpile						
1 130	475	600	650	425	425	3,700	3,070	247	75	0	75	0	25	2	108"			
2 139	427	609	306	650	02	3,406	3,303	106	0	0	0	0	25	3	85			
3 160	95	103	120	70	077	1,176	3,324	730	0	0	0	0	20	1	01"			
4 166	114	156	140	130	320	4,970	4,435	063	0	0	0	0	23	3	107"			
5 200	51	1,140	922	269	650	5,151	4,721	1,000	0	0	0	0	20	1	93"			
6 182	0	02	02	0	364	1,106	2,070	601	0	0	0	0	19	2	73"			
7 116	4	0	4	0	710	4,066	3,757	1,020	0	0	0	0	19	1	60"			
TOTAL 1101	1,166	2,690	2,312	1,544	3,436	27,503	26,200	4,735	75	0	75	0	22	2	89"			

TABLE III-7

MASSACHUSETTS TURNPIKE AUTHORITY

SODIUM CHLORIDE USE

WINTER SEASON 1976-77

<u>MAINT. SECTION</u>	<u>SALT USED TONS</u>	<u>NO. OF STORMS</u>		<u>ACCUMULATION INCHES</u>
		<u>SNOW</u>	<u>SLEET OR ICE</u>	
1-Lee	3,878	25	2	108
2-Blandford	3,303	25	3	85
3-Chicopee	3,324	20	1	81
4-Warren	4,435	23	3	107
5-Auburn	4,721	20	1	98
6-Weston	2,870	19	2	73
7-Boston Ext.	3,757	19	1	68
TOTALS	26,288	22 Ave.	2 Ave.	89" Ave.

<u>WINTER</u>	<u>SALT USE</u>	<u>TONS/LANE MILE</u>	<u>REDUCTION</u>	<u>ACCUMULATION INCHES</u>
1975-76	36,025	32.8	26.8%	82"
1976-77	26,288	24.0		89"
5 Year Mean 1971-1976	37,400 Ave.	34.0	29.4%	87" Ave.

III B.1. (Cont.)

The Metropolitan District Commission reported that agency used a mixture $1/3$ salt and $2/3$ sand for the winter season 1975-76. When severe icing conditions existed straight salt was applied. The total quantity of deicing chemicals applied on a total of 593 lane miles of Metropolitan District Commission roadways was 13,124 tons. This breaks down to 22 tons per lane mile and a rate of 300-400 pounds per lane mile per application. The statistics for the winter season 1976-77 are 11,517 tons of salt at the same application rate over the same total number of lane miles. It averages out to 19 tons per lane mile.

The Massachusetts Bay Transportation Authority used a total of 5,925 tons of deicing chemicals for the 1975-76 winter season, 5,374 tons for the 1976-77 winter season, and 4,958 tons for the 1977-78 winter season.

2. Sensitive Areas

The Massachusetts Department of Public Works studied three sensitive sites this past winter. These sites were:

- 1) The Cambridge Reservoir in Waltham, adjacent to Routes 128 and 2
- 2) A well site in Weymouth at the interchange of Routes 3 and 18
- 3) A well site in Reading adjacent to Routes 1-93 and 129

The maps showing the location of these sites and a more detailed explanation of each is presented in Section VI of this report.

In the Cambridge Reservoir Watershed, for the winter of 1976-77, the Department applied 1,036 tons of deicing chemicals on 79 lane miles of State highway. This breaks down to 13 tons per lane mile per year.

III 3.2. Cont.

With a total snowfall of 86 inches of snow in the district for the 1976-77 winter season, there was an average of 6.55 inches of snow treated per ton of salt per lane mile. The Statewide average was 5.55 inches of snow treated per ton of salt per lane mile as shown in Table III-3. This also represents a substantial improvement from the previous winter in which 53 inches of snow was treated with 1,864 tons of salt which is 2.24 inches of snow treated per ton of salt per lane mile. Efficiency is related to closer supervision while maintaining the same level of driving quality. This required no change in driver habits without significant increase in driver complaints.

The Weymouth well site, located in the interchange area of Routes 3 and 18, is used irregularly for water supply. It is planned that this well will be utilized more after 1980. In order to reduce any impact that the Massachusetts Department of Public Works Snow and Ice Control operations might have on the town wells, an effort was made to reduce the application rate of chemicals. The horizontal and vertical alignment, as well as the traffic volume, presented a potentially hazardous condition should ice pack take place. Through increased monitoring of roadway conditions and close supervision the minimum amount of deicing chemicals was applied. The installation of a closed drainage system and other engineering techniques are also being considered in this area, but no absolute solution has been developed yet.

- III B.2. Cont.

At the Reading site, which is adjacent to Routes 1-93 and 129, it is the contention of the Department that the salt from the storage area plus the highway system is a minor contributing factor to the total sodium concentration of the water after treatment at the 100 Acre Meadow Treatment Plant. The Treatment Plant adds significant amounts of sodium in an effort to reduce the iron and manganese content from the wells in the 100 acre Meadow Site. There were no studies this past winter, but a study program is in the planning stages to determine the percent of contribution from salting on 1-93.

Neither the Massachusetts Turnpike Authority, the Metropolitan District Commission, nor the Massachusetts Bay Transportation Authority considered specific sensitive sites for the winter of 1976-1977. The Massachusetts Turnpike Authority is awaiting the designation of sensitive sites by the Massachusetts Department of Environmental Quality Engineering before it institutes any definite procedures relating to sensitive sites.

3. Sodium Standard

In the fall of 1976, the Department of Environmental Quality Engineering was directed by the Secretary of Environmental Affairs to adopt a sodium standard for safe drinking water in Massachusetts. In response to this directive, the Department of Environmental Quality Engineering issued, in March of 1977, draft "Drinking Water Regulations of Massachusetts" which were available for public review and comment. One of the major elements of these regulations was the establishment of a sodium standard. Public hearings

III B. 3. Cont.

on these proposed regulations were held: on April 11, 1977 in Lakeville; on April 12, 1977 in Boston; on April 14, 1977 in Holyoke; on April 20, 1977 in Worcester.

Comments were submitted both for and against the adoption of the proposed sodium standard. After review of the comments, the final "Drinking Water Regulations" were adopted by the Department of Environmental Quality Engineering on June 24, 1977. The standard for sodium is as follows (2):

Maximum Contaminant Level.....20 Milligrams per liter

Any other provision of these regulations to the contrary notwithstanding, a supplier of water may supply to the users thereof, without obtaining a variance of exemption and without being subject to any enforcement action water which exceeds this maximum contamination level for Sodium, but only if the supplier of water reports to the Department pursuant to Sec. 15 and gives notice to the public pursuant to Sec. 16.

Monitoring Requirements for Community Water Systems Utilizing Surface Water Sources In Whole Or In Any Part:

Initial Analysis to be completed by June 24, 1978. Thereafter at 1 year intervals. If the level of sodium exceeds 15 milligrams per liter, the analyses shall be repeated quarterly.

Monitoring Requirements for Community Water Systems Utilizing Only

Ground Water Sources:

Initial Analysis to be completed by June 24, 1979. Thereafter at 3 year intervals. If the Sodium level exceeds 15 milligrams per liter, the analyses shall be repeated quarterly.

III B. 3. (Cont.)

All Non-Community Water Systems:

Initial Analysis to be completed by June 24, 1979. Thereafter at intervals determined by Department. If the Sodium level exceeds 15 milligrams per liter, the analyses shall be repeated quarterly.

The Department of Public Works recognizes that deicing chemicals used in the snow and ice control program can increase the sodium content of water supplies; however, it should be pointed out that there are no viable chemicals available at this time which can be used as a substitute. No special chemical treatment program for sensitive sites will be implemented by the Department as this would create a hazardous situation by changing road surface conditions on contiguous stretches of roadway. By following the procedures outlined in Section III B.1. and VII D.3. respectively, the Department is confident that it can control the amount of deicing chemicals used minimizing the possible environmental impacts of their use.

The Massachusetts Department of Public Works, the Massachusetts Turnpike Authority, the Metropolitan District Commission and the Massachusetts Bay Transportation Authority are attempting to minimize any possible environmental impacts, such as the sodium contamination of water supplies, which may result from the application of deicing chemicals. However, these agencies are not the sole contributors to possible sodium contamination. This cooperative effort must also involve other members of the public and private sector, such as municipalities, industrial and commercial development, and private households.

III.B.3. Cont.

Deicing chemicals are only one of the possible sources of sodium. Sodium compounds are also used in certain water treatment methods, such as water softening and corrosion control. Sodium is also found in significant concentrations in various foods and beverages. (3)

- (1) Massachusetts Department of Public Works, Maintenance Section, "Report on Test and Control Sections and General Deicing Chemical Use - Winter 1975-76", Boston, Massachusetts. (1976)
- (2) Massachusetts Department of Environmental Quality Engineering, "Drinking Water Regulation of Massachusetts", Boston, Massachusetts. (1977)
- (3) Weickart, Richard, "Sodium in Food, Medicine and Water", Water Quality Association.
- (4) Report on Test and Control Sections and General De-Icing Chemical Use - Winter 1975-1976, Commonwealth of Massachusetts, Department of Public Works.

IV OPERATIONS

IV A. Equipment

I. Winter 1975-1977, History

The Massachusetts Department of Public Works has been proceeding with the modification of its own spreading equipment as rapidly as funds permit. Thus far the Department has installed one hundred (100) synchrometers and gear reduction boxes on the four-hundred (400) State owned spreaders. The installation of automated equipment mechanically insures that minimal application rates and even distribution of chemicals is achieved. With a program of offering an increase of \$9.00 in the hourly rate for automated and properly modified hired spreaders, the Department of Public Works has been able to induce a 68% voluntary changeover. Also, by directive, all non-automated hired and State spreaders must be calibrated for performance and the deficiencies compensated with sand. As a part of the Department educational program with municipalities, all participants were made aware of equipment and techniques available.

The Massachusetts Turnpike Authority purchased in 1977 five (5) new 4-wheel drive snowfighters with front, wing plows, center scrapers, and new spreaders equipped with ground control salt spread application sensors. Each one of the Turnpike Authority's sixty-two (62) salt spreaders is now equipped with salt application spreader controls. Four (4) loaders (3 C.Y. capacity) with front and wing plows were purchased in 1977 replacing four (4) graders for interchange and service area plowing. The Massachusetts Turnpike Authority employs the following Authority owned equipment in its Snow and Ice Control operations.

IV OPERATIONS

IV A. Equipment

I. Winter 1975-1977, History

NUMBER OF UNITS

EQUIPMENT ON UNITS

17 Trucks	Sensors,	Spreaders,	Front Plows,	Wing Plows,	Center Scrapers
25 Trucks	Sensors,	Spreaders,	Front Plows,	Wing Plows,	

For the Massachusetts Turnpike Authority, it is anticipated that eight (8) remaining gasoline motor trucks will be replaced with small diesel engine trucks within the next two (2) years. The replacement within the next two (2) years of three (3) graders is also being reviewed. Replacement of the six (6) 1969 salt spreader control devices with new ones is programmed for 1977. The following table indicates the proposed program of upgrading and replacement of equipment used in snow and ice control in the years as indicated.

PROPOSED SCHEDULE OF REPLACEMENT OF SNOW & ICE EQUIPMENT

YEAR, MAKE & TYPE EQUIPMENT

	1977	1978	1979	1980	1981
--	------	------	------	------	------

1971 L800 Trucks	6				
------------------	---	--	--	--	--

1958 Austin-Western Grader		3			
-------------------------------	--	---	--	--	--

1971 L900 Trucks		2			
------------------	--	---	--	--	--

1969 Trojan Loader			3		
--------------------	--	--	---	--	--

1970 Trojan Loader				3	
--------------------	--	--	--	---	--

1972 Allis-Chalmers Loader					3
-------------------------------	--	--	--	--	---

1957 Walter Sicard Snow Blower					2
-----------------------------------	--	--	--	--	---

IV OPERATIONS

IV A. Equipment

I. Winter 1975-1977, History

The Metropolitan District Commission has embarked on a program to replace existing chemical spreaders with improved equipment to minimize chemical use.

The Massachusetts Bay Transportation Authority will be purchasing new equipment when needed and as funds allow.

<u>NUMBER OF UNITS</u> (Continued)	<u>EQUIPMENT ON UNITS</u> (Continued)
------------------------------------	---------------------------------------

13 Trucks	Sensors, Spreaders, Front Plows
5 Trucks	Front Plow Only
4 Loaders	Front & Wing Plows
7 Loaders	Bucket & Plow
12 Loaders	Bucket Only
5 Sicard Trucks	Snowblowers
6 Graders	Front & Wing Plows, Center Grader Blade
94 Total	

The Metropolitan District Commission has: Sixty-one (61) dump trucks with plows; thirty-seven (37) dump trucks with plows and spreaders; nine (9) bombardiers (sidewalk plows) and three (3) pick-ups with plows. The spreaders have no automated controls. Due to the age of some of the equipment, several equipment breakdowns were experienced. No equipment was hired by the Metropolitan District Commission.

The Massachusetts Bay Transportation Authority's snow fighting fleet has been greatly depleted due to the age and condition of the equipment.

IV OPERATIONS

IV A. Equipment

1. Winter 1975-1977, History

Consequently the Authority was required to hire private contractors to supplement its own equipment.

2. Winter 1977-1981, proposals

The goal of the Massachusetts Department of Public Works is a 100% automation of both hired and State owned spreaders as soon as possible. There is no definite timetable for complete automation as it will be contingent upon budget allocations. With full automation of the spreading equipment, efficient and minimal use of deicing chemicals will be attained. Also, canvas covers to protect loads in trucks will be utilized.

IV B. Maintenance Sites

1. Winter 1975-1976, history

The Massachusetts Department of Public Works, prior to this past winter season, had constructed sixty-six (66) salt storage sheds. This past winter one hundred and five (105) additional sheds were constructed, by contract, for a total of one hundred and seventy-one (171). Approximately 80% of the Department of Public Works annual usage of deicing chemicals is now housed in these storage sheds.

The construction of these storage sheds throughout the State is a major step in controlling salt intrusion into drinking water supplies. Other advantages of the storage sheds are: dry salt for easy metering: a safeguard against shortages or strikes: and price gains by earlier purchase.

Storage sheds have a standard cross-section with a forty (40) foot

IV B. Maintenance Sites

1. Winter 1975-1976, history

width and eighteen (18) foot height with lengths ranging from sixty (60) feet to one hundred and eight (108) feet, in twelve (12) foot increments. The capacity of a 84 foot long shed is approximately 1000-1200 tons. Each shed has a bituminous concrete floor, sliding doors, aluminum roofing and wooden walls. In the front of a shed is a paved, impervious apron, and all loading areas are impervious through sealed bituminous concrete. Sites for storage shed locations are selected in areas remote from water supplies and runoff is deflected away from water sources.

The Department of Public Works needs approximately thirty-five (35) more storage sheds; however, these involve sites which the State does not own and therefore upon which the State cannot build. On these sites the chemicals are stored on bituminous concrete pads and covered with polyethylene covers.

The Massachusetts Turnpike Authority storage shed program completed in 1972 includes seven (7) major depots with salt storage buildings and one (1) smaller intermediate storage shed.

All of the Metropolitan District Commission's storage sites are lighted temporary areas, with an average of 250 tons each of salt and sand. At the end of a winter season, the remaining materials are removed from the stockpile for storage elsewhere. The Commission has allocated \$300,000 from its 1977 Highway Improvement Loan Fund for the purpose of constructing five new salt storage sheds in existing MDC maintenance yards at Middlesex Fells, Charles River Upper, Blue Hills, Nantasket and Stonybrook. In

IV B. Maintenance Sites

1. Winter 1975-1976, history

additions, funds have been requested in the 1979 capital outlay budget for permanent sheds to replace temporary storage facilities in Revere, Old Colony and Charles River Lower. It is anticipated that construction of the five sheds currently funded will be completed within the next three years.

The Massachusetts Bay Transportation Authority has only one storage site and this is located on Arlington Street in Charlestown, Mass.

2. Winter 1977-1981, proposals

The goal of the Massachusetts Department of Public Works is to have one shed for sodium chloride and one shed for pre-mix on all storage sites where prudent. As stated previously, the Department still needs approximately thirty-five (35) more storage sheds, but cannot erect these because the sites are on leased land. Acquisition of new maintenance sites will depend on availability of funds. This proposed acquisition and development program is estimated at twelve million dollars (\$12,000,000). Two million dollars (\$2,000,000) is available from the 1977 Accelerated Highway Program. This is a long term project and may require, in addition to land takings, individual EIR's for certain sensitive sites.

The Massachusetts Turnpike Authority needs two (2) additional sites for intermediate salt storage sheds and will be reviewed for possible building in the next two years.

The Metropolitan District Commission will continue to seek additional funds for maintenance site improvements in the yearly budget.

The Massachusetts Bay Transportation Authority has no specific proposals at this time.

IV C. Education

1. Winter 1975-1977, history

For the past twenty years the Massachusetts Department of Public Works has been conducting training sessions for maintenance field crews in the proper use of materials and equipment. These sessions, held in the fall of each year, run for about three and one-half hours and are conducted by the Department's Snow and Ice Control Engineer with the assistance of the Wellesley Depot personnel.

For the past two seasons the emphasis has been on reapplication techniques and the methods of calibrating spreaders. Proper reapplication timing is the essence of achieving minimal chemical output. The other major topics include the possible environmental consequences resulting from chemical misuse and the latest research towards the development of better chemicals, equipment and practices.

The Massachusetts Turnpike Authority held Snow and Ice Control seminars, including the use of films, with all personnel. Separate sessions for all personnel on proper salt application and calibration of spreaders were conducted by members of the Salt Institute. Subsequent reviews and discussions were conducted by members of Motor Equipment Division on the understanding and use of the spread control sensors. Separate sessions were held with the Division Engineers, Supervisors, and Foremen stressing the need for continued monitoring and stressing minimal salt use requirements.

The Metropolitan District Commission held periodic staff meetings with the appropriate snow and ice control personnel.

IV C. Education

2. Winter 1977-1981, proposal

The Massachusetts Department of Public Works will continue with the annual training sessions. In addition, as better methods of chemicals application are developed and as more sophisticated spreading equipment becomes available the Department will administer the appropriate training. Also continued emphasis will be given to the possible environmental consequences resulting from chemical misuse.

The Massachusetts Turnpike Authority proposes to continue and increase the training of our personnel through extended and more extensive Snow & Ice Control seminars. It is anticipated that more small group sessions and one-on-one educational training periods will be developed. Additional ways will be looked for to upgrade training techniques such as audio and visual presentations, as well as the need to stress the importance of environmental affects to water supplies which could develop through over use of salt.

The Metropolitan District Commission will continue to hold staff meetings with the appropriate snow and ice control personnel. Also the Metropolitan District Commission plans to send some of its supervisory personnel to the snow and ice control school operated by the Massachusetts Department of Public Works. The Parks Division which is responsible for the maintenance of Metropolitan District Commission parkways is committed to the reduction of the use of deicing chemicals.

IV D. Budget

I. Winter 1975-1977, history

The Massachusetts Department of Public Works Snow and Ice Control budget for materials is as follows:

SNOW AND ICE CONTROL MATERIALS
(salt, pre-mixed chemicals and sand)
Acct. #6030-7201-09

SEASON	1974-1975	1975-1976	1976-1977
BUDGET REQUEST	\$3,810,000	\$3,698,000	\$3,000,000
APPROPRIATION (GEN.APPROP.ACT)	\$3,799,000	\$3,298,000	\$3,000,000
SUPPLEMENTAL APPROPRIATION	\$- 633,000 (Transfer to other subsidiary)	0	\$ 770,000
TOTAL APPROPRIATION FOR YEAR	\$3,166,000	\$3,298,000	\$3,770,000
EXPENDITURES	\$3,128,758	\$3,274,688	\$3,740,863

PLOWING AND SPREADING COSTS

SEASON	1975-1976	1976-1977
PLOWING	\$4,639,974	\$5,529,789
SAND & CHEMICAL Appl.	\$6,369,629*	\$6,538,385*
SNOW FENCE	\$ 78,385	\$ 68,738
CLEANING WATERWAYS	\$ 531,631	\$ 802,486
RAMPS, BRIDGES, SNOW REMOVAL	\$ 88,914	\$ 132,716
SAND REMOVAL	\$ 849,402	\$1,018,660
OTHER, INCL. ROAD CONTROL	<u>\$ 490,133</u>	<u>\$ 610,907</u>
TOTAL	\$13,048,568	\$14,701,681

IV D. Budget

I. Winter 1975-1977, history

Notwithstanding equipment deficiencies, the magnitude of the snow and ice operations mandate that the Department supplement its capabilities with hired equipment in sufficient number as the storm conditions warrant.

*Includes cost of materials.

In the past 5 years, hired equipment has been utilized in the following amounts:

<u>SEASON</u>	<u>EXPENDITURES</u>
1971-1972	\$4,775,936.00
1972-1973	\$3,000,000.00
1973-1974	\$3,065,000.00
1974-1975	\$3,170,000.00
1975-1976	\$5,200,000.00

It has been estimated that between 20% and 25% of these expenditures are necessary because of the condition of the Department's own equipment. The remainder was required to maintain highway travel during the storms. For the Department to own, operate and maintain a fleet of this magnitude would be neither prudent nor economical. For this reason the Department hires equipment only when storm conditions deem necessary.

The following is the Massachusetts Turnpike Authority's Snow and Ice Control budget for the past two winters.

SEASON	1975-1976	1976-1977
MATERIAL	\$576,481.00	\$475,411.00
HIRED EQUIPMENT	\$ 37,712.00	\$ 55,195.00
TOTAL	\$616,193.00	\$530,606.00

IV D. Budget

1. Winter 1975-1977, history

The Metropolitan District Commission does not specifically budget funds for Snow and Ice Control practices. This is included in the twelve months maintenance budget. The total cost of Metropolitan District Commission Snow and Ice Control is approximately \$259,00.00 per winter for materials only.

2. Winter 1977-1981, proposals

The Massachusetts Department of Public Works intends to continue the use of pre-mix (4 parts sodium chloride to 1 part calcium chloride) which would help reduce salt usage at lower temperatures. As stated previously twelve million dollars (\$12,000,000.) is needed to acquire and completely develop the Department's own Maintenance sites including chemical storage sheds.

For the replacement and addition of new equipment which would produce the most efficient and cost effective benefits the Department should be expending \$3,750,000. per year. This would be on a rotation replacement basis of fleet units according to their useful life cycles. Except for the 4-wheel drive snow fighters, the vehicles involved in snow and ice control operations are multi-purpose vehicles used year round for many other operations and purposes. Even though our average annual snow and ice operations occur during 60 calendar days, quite often they are 24 hour work days, under the worst possible operating conditions and cause the most wear and tear to our equipment.

The expenditure of \$3,750,000.00 per year for equipment on the fleet rotational basis would allow for annual purchases as follows:

IV D. Budget

2. Winter 1977-1981, proposals

<u>UNIT</u>	<u>REPLACEMENT/YR.</u>	<u>UNIT COST</u>	<u>TOTAL</u>
Dump Trucks w/Plow & Spreader Unit	50	\$30,000.00	\$1,500,000.00
Stake & Rack Trucks w/Plow	27	\$25,000.00	\$ 675,000.00
Font-end Loaders	10	\$30,000.00	\$ 300,000.00
Snow Fighters-4 Wheel Drive Truck	8	\$45,000.00	\$ 360,000.00
Pick-up Trucks	70	\$ 5,500.00	\$ 385,000.00
Utility Trucks	12	\$10,000.00	\$ 120,000.00
Power Sweeper-Self unloading	9	\$35,000.00	\$ 315,000.00
Automobiles	20	\$ 4,500.00	\$ 90,000.00
		TOTAL	\$3,745,000.00

The Department of Public Works authorized expenditures for equipment over the past 7 years have been as follows:

<u>Fiscal Year</u>	<u>Expenditures</u>
1969-1970	\$1,866,581.00
1970-1971	\$1,995,246.00
1971-1972	\$1,320,849.00
1972-1973	\$ 664,887.00
1973-1974	\$ 16,071.00
1974-1975	\$1,085,911.00
1975-1976	\$2,207,447.00

With these spending limitations, the Department has fallen far below the level of efficient and cost efficient operations. It is estimated that an immediate expenditure of \$12,000,000.00 would have to be made to bring the fleet up to an efficient operational level. At the request of the Massachusetts Department of Public Works, \$1,000,000.00 was included in the

IV D. Budget

2. Winter 1977-1981, proposals

Transportation Bond Issue for the construction of salt storage sheds for cities and towns.

The Massachusetts Turnpike Authority anticipates no major changes for winter budgets for 1977 through 1981 other than anticipated inflationary trend in costs of materials, and a constant effort toward material use reduction.

As stated previously the Metropolitan District Commission does not specifically budget funds for snow and ice control but includes the cost in the yearly maintenance budget.

V. NEW TECHNIQUES

The construction of "Snow Ramps" in some locations may be desirable. These "Snow Ramps" allow the trucks to safely and quickly reverse direction by crossing over or under a limited access highway by utilizing local roads that do not ordinarily have access to the highway. In addition to the increased efficiency which they provide, these ramps also eliminate dangerous crossings and/or extra miles of travel to reverse direction. Over the past few years the Massachusetts Turnpike Authority has built some of these ramps.

Recently road and/or bridge icing detectors have been developed, but as of yet their effectiveness has not been determined. These detectors are installed in the road or bridge surface and will send to a central location by telephone or radio transmission an audio and visual signal indicating that the surface is safe, wet, about to ice, and iced. The development of mobile ice detection equipment is also moving ahead. If these instruments prove effective, they could significantly increase the capability of maintaining a safe road and eliminating unnecessary or premature application of deicing chemicals.

As previously stated, the goal of the Massachusetts Department of Public Works is 100% use of ground speed sensors. Each one of the Massachusetts Turnpike Authority's spreaders is now equipped with sensors. Ground speed sensors insure that the minimum amount of deicing chemicals is being applied by accurately and automatically adjusting the spreading rate to changing vehicle speeds. Both open and closed loop systems are used. A closed loop system monitors both ground speed and material feed rate. Regardless of vehicle speed, gear selection, direction, load

V. NEW TECHNIQUES

changes or other variables, plus or minus 2% accuracy can be maintained for a particular application rate when ground speed and application rate sensors are used. Open loop systems are controlled only by the vehicles ground speed. In ground oriented systems the open loop system requires the smallest initial investment.

There are continuing studies of various techniques of pre-wetting sodium chloride with a liquid calcium chloride. It has been argued that lesser quantities of salt application are required, particularly in temperatures below 20° F. Some authorities feel that with pre-wetting, the salt pellets do not bounce off the roadway and therefore less material is needed: however, Massachusetts officials do not believe this technique to be beneficial.

VI SENSITIVE SITES

On October 29, 1976, the Secretary of Environmental Affairs issued the response to the revised Draft Environmental Impact Report for the Snow and Ice Control Programs of the Massachusetts Department of Public Works, the Metropolitan District Commission, the Massachusetts Turnpike Authority and the Massachusetts Bay Transportation Authority. In this response certain policy steps were recommended for implementation. Two of the steps were; step 3, "The DEQE (Department of Environmental Quality Engineering) shall identify major important water sources where present water quality seriously exceeds the interim sodium standard", step 5, "The Massachusetts Department of Public Works shall, upon being advised by the DEQE of the water sources identified in step 3, take all feasible means immediately to institute a low-salt selective level of service policy on stretches of State highways where salt application might adversely affect water quality of such sources". The procedure outlined in Section III B.1., will be used to implement this policy, reduction in frequency of applications, closer monitoring, calibrated equipment, and sensitive automated devices. The Department of Environmental Quality Engineering is an agency within the Executive Office of Environmental Affairs (EOEA).

VI SENSITIVE SITES, (Cont'd)

Figure VI-1 shows cities and towns in which one or more of the municipal water supplies has a sodium concentration in excess of 20 ppm (parts per million).

In response to the recommendations of the Secretary of Environmental Affairs meetings were held between the Massachusetts Department of Public Works and the Executive Office of Environmental Affairs. EOEa presented eight sites which were identified as being sensitive and believed to be within the area of influence of State highways. A primary criteria which was used by the Executive Office of Environmental Affairs in their choice of sensitive sites was that the activities of the Department of Public Works had to be the sole potential source of impact. Therefore, due to this criteria, Route 12 and I-90, Route 128 and I-90, and other locations of heavy development were not considered. The eight sites initially proposed were:

- 1) Route 123, Scituate
- 2) Routes I-93 and 129, Reading
- 3) Route 109, Westwood
- 4) Routes 3 and 18, Weymouth
- 5) Routes 128 and 2, Waltham (Cambridge Reservoir)
- 6) School Meadow Brook, Walpole
- 7) Route 9, Framingham
- 8) Walkers Brook, Framingham

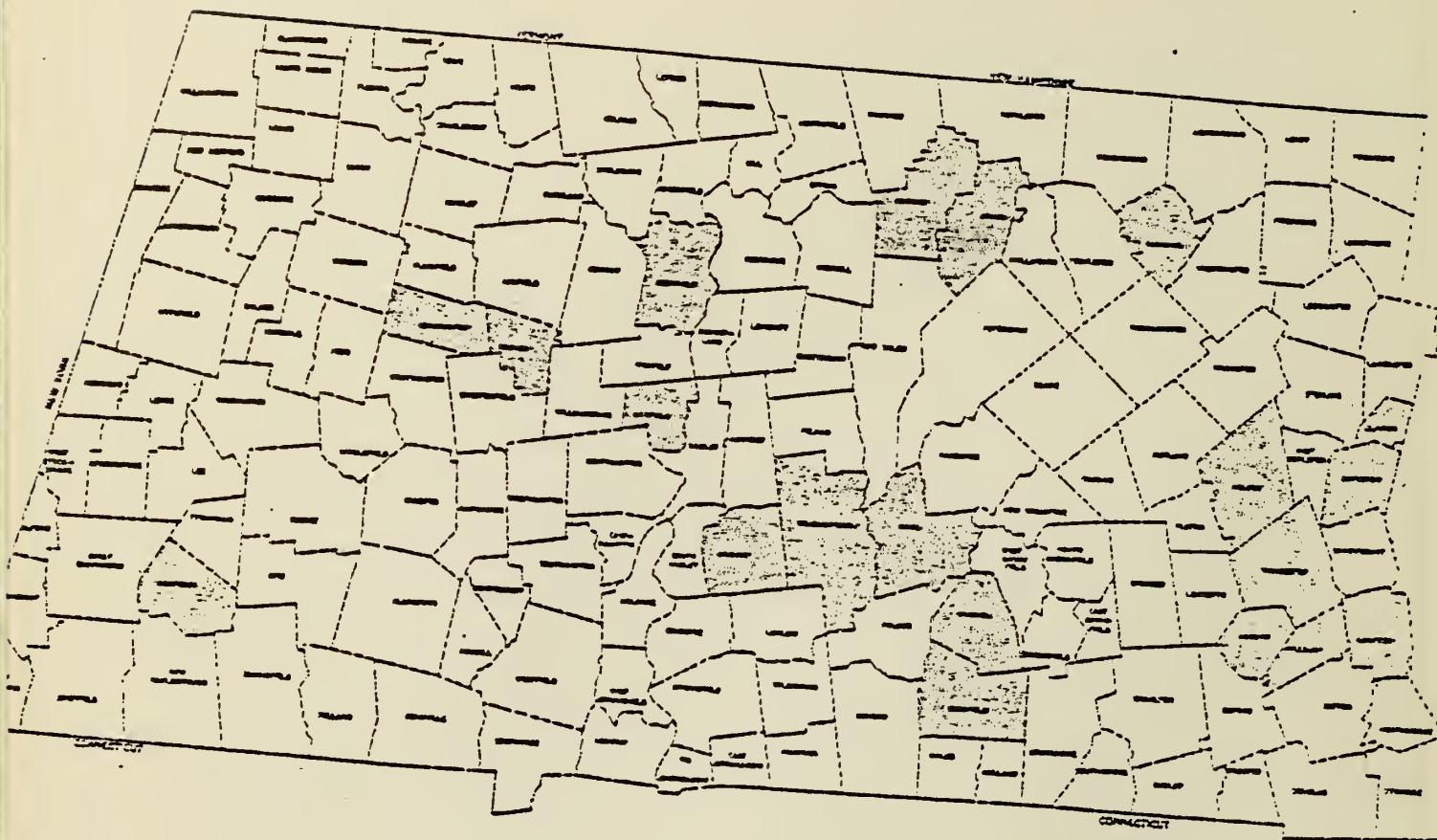
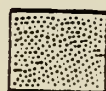


FIGURE VI-1

Salt Contamination

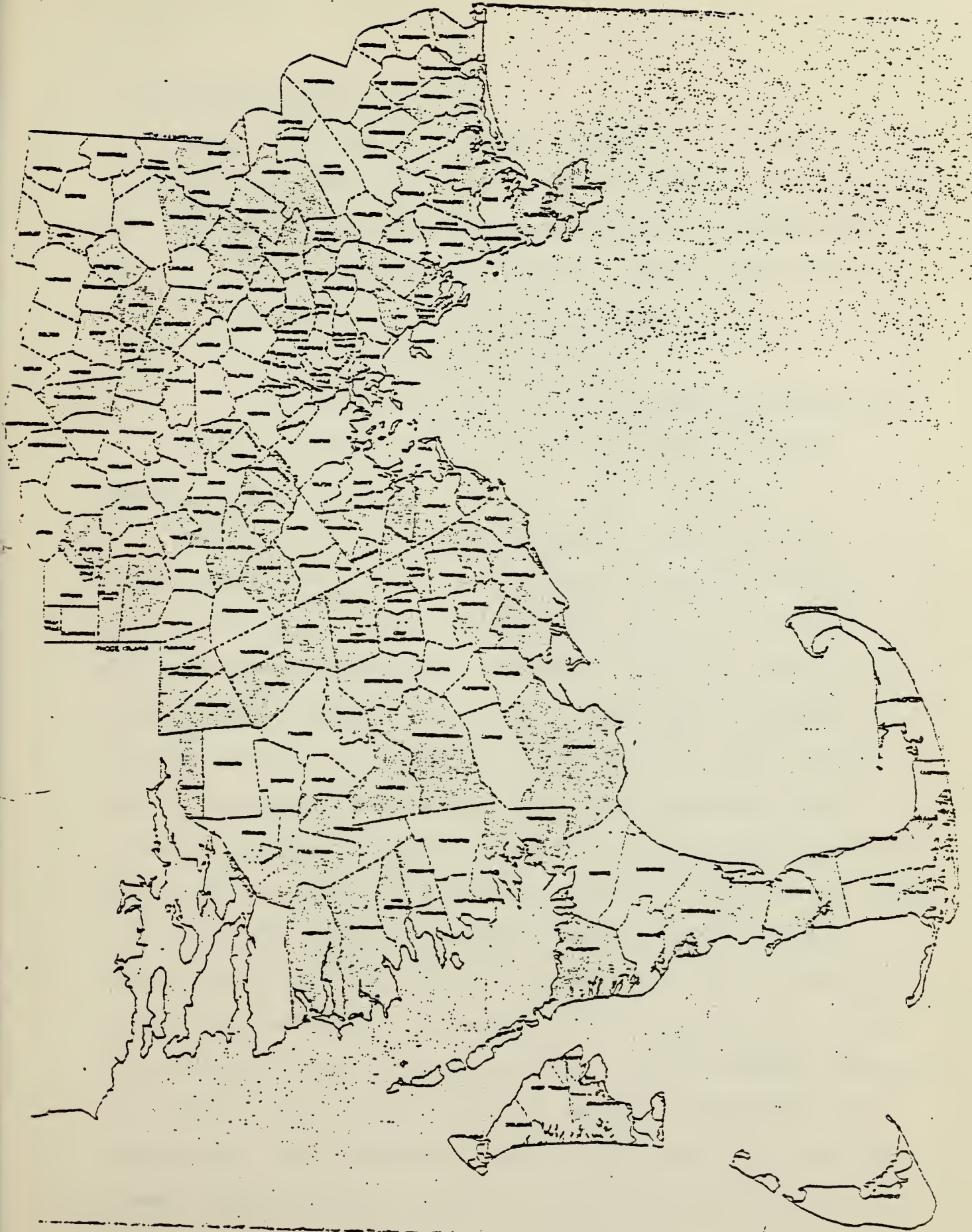
Legend



One or More Municipal Supplies
Showing in Excess of 20 ppm
sodium

Source: Division of Environmental Health

SOURCE: Massachusetts Water Supply Policy Study
Executive Office of Environmental Affairs



VI SENSITIVE SITES, (Cont'd)

Through subsequent meetings, correspondence and investigations it was determined and agreed upon by both agencies that only three sites met the aforementioned criteria and would be considered for further study. These sites were:

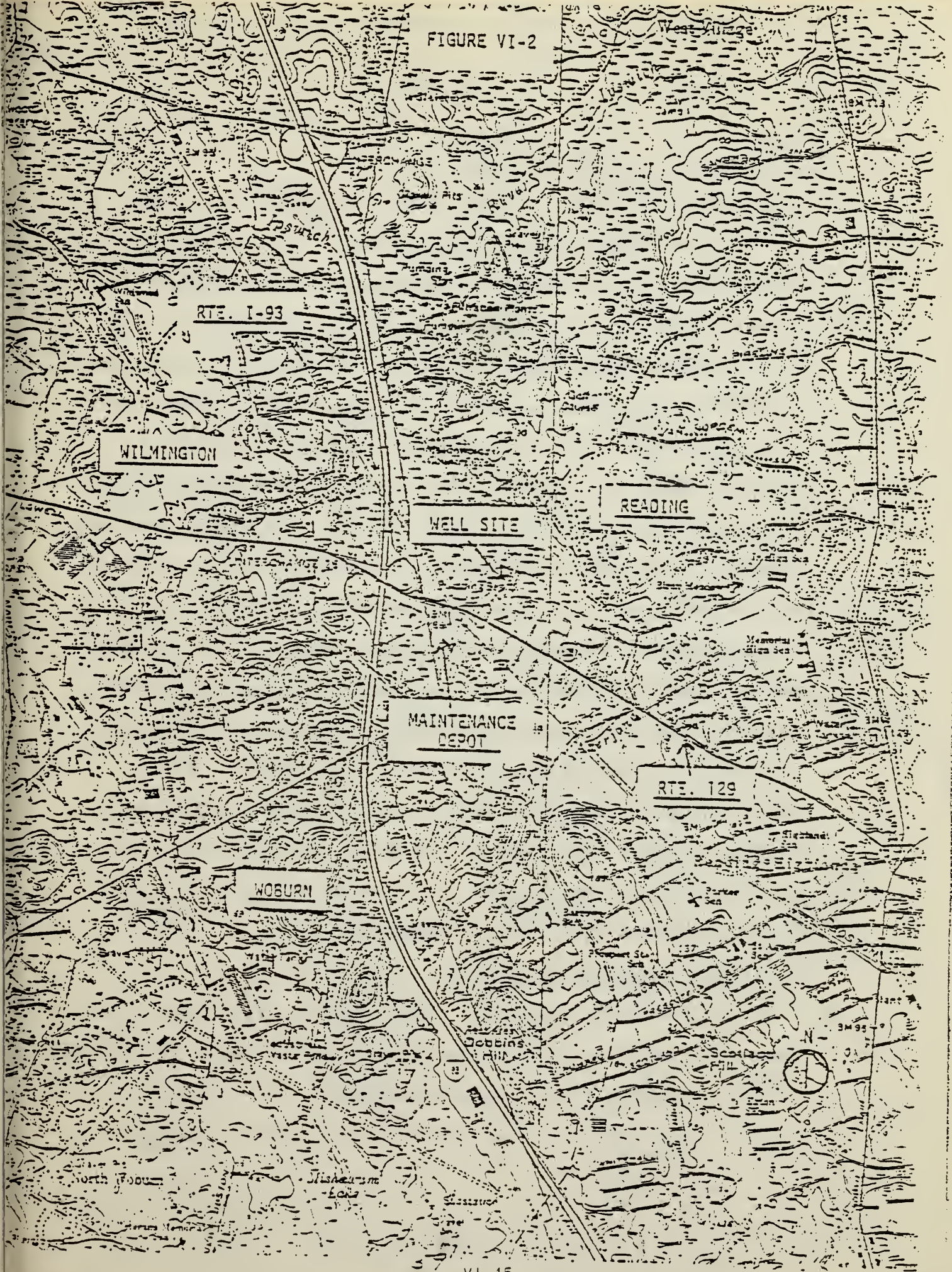
- 1) Routes I-93 and 129, Reading
- 2) Routes 3 and 18, Weymouth
- 3) Routes 128 and 2, Waltham (Cambridge Reservoir)

A brief description of each of the studies follows:

Reading Site

The location of the Reading site is adjacent to the interchange of Routes I-93 and 129 and is shown in Figure VI-2. Originally a complaint was made that salt stored at the Massachusetts Department of Public Works maintenance pit on Causeway was adding chlorides to the Revay #1 pumping station. Revay #1 is 1200 $\pm$ feet away from the salt storage area. Recommendations at the time of the complaint were to cover the deicing chemicals, seal the pavement in the maintenance yard and close all open catch basins. Observation wells were installed and monitored quarterly until 1970-1971. Original estimates were that it would take 5 to 10 years for maximum concentration of chlorides in the ground water below the maintenance pit to reach Revay #1. This original estimate was holding true, as determined by periodic sampling of the observation wells; however, recently the timing has been extended due to removal of Revay #1 from high service usage and

FIGURE VI-2



VI SENSITIVE SITES, (Cont'd)

shut down. Presently, Revay #1 is scheduled to be placed on low service and combined with other wells from the 100 Acre Meadow Well Field at the treatment plant. Recent events, such as the possible up-grading of the Route I-93 and 129 Interchange have caused the Department to re-examine the area. It is the belief of the Massachusetts Department of Public Works that salt from the storage area plus the highway System is a minor contributing factor to the total sodium levels in the water from the 100 Acre Meadow Treatment Plant. The 100 Acre Meadow Treatment Plant adds significant amounts of a sodium compound in an effort to reduce the iron and manganese concentrations from the wells in the 100 Acre Meadow Site. The Department is planning to install, in the near future, additional observation wells to monitor salt movement from the highway as well as the storage site. Materials have been ordered and preliminary engineering has begun for a pump test of the Revay #1 well. When sufficient manpower is available to pump and monitor the test wells, the pump tests will be initiated.

Cambridge Reservoir Site

The Cambridge Reservoir, also known as the Hobbs Brook Reservoir, is located adjacent to Routes 128 and 2 and is one of three reservoirs which supplies water to the City of Cambridge. Figure VI-3 is a map of the reservoir and shows

VI SENSITIVE SITES, (Cont'd)

the locations of the water sampling sites. Prior to the designation of this area as a sensitive site the MDPW had already initiated a study of salt intrusion into the reservoir. Norumbega Association proposed the idea of this study which would "develop an analytical technique to permit rapid predictions of the effects of salt, in relation to "unprotected" lane mileage of highways, on the water of each watershed ". Various agencies are involved in this study which is a cooperative effort of the Department of Public Works, the Department of Environmental Quality Engineering, the City of Cambridge and Norumbega Association with the assistance of the Waltham League of Women Voters, the Lexington Conservation Commission and the Lincoln Conservation Commission. The study was to have provided the necessary data to develop predictions of the effect of the use of highway deicing salts upon the water quality of a surface water supply adjacent to a highway. Water samples were obtained weekly at various locations around the reservoir and analyzed both by the Department of Public Works and the City of Cambridge. Precipitation data used was compiled from the records of the Massachusetts Water Resources Commission. The total amount of deicing chemicals applied to the State highways and local roads in the watershed was determined, as was the amount of chemicals applied to commercial parking areas in the watershed. Considerable

VI SENSITIVE SITES, (Cont'd)

data was gathered concerning the foregoing parameters; however, no data was obtained for the volumes of water in, or flowing through the reservoir. Due to the lack of this data the study must be repeated next winter before a final report can be issued. An interim report is available from Norumbega Association and the raw data obtained thus far is available from the Environmental Section of the Massachusetts Department of Public Works. As stated in Section III B.2, the Department applied 1036 tons of deicing chemicals on 79 lane miles of State highway. This is 13 tons per lane mile per year. With a total snowfall of 86 inches of snow for the 1976-1977 winter season there was an average of 6.55 inches of snow treated per ton of salt per lane mile.

Weymouth Site

The Weymouth well site, located in the Interchange area of Routes 3 and 18, as shown in Figure VI-4, is used irregularly for water supply. It is planned that this well will be utilized more after 1980. In order to reduce any impact that the Massachusetts Department of Public Works Snow and Ice Control operations might have on the town wells, an effort was made to reduce the application rate of chemicals. The horizontal and vertical alignment, as well as the traffic volume, presented a potentially hazardous condition should ice pack take place. It was determined by trial that a 50%

This topographic map, titled "FIGURE VI-4", depicts the South Keyport area. The map features a proposed "WELL SITE" marked with a circle and crosshairs, located near the intersection of "RTE. 3" and "RTE. 18". Other labeled features include "Village Camp", "Homeside", "Read Camp", "INTERCHANGE", "Lovell Corners", "Rest Areas", "Fairgrounds", "South Keyport", "Highway", "Fire Station", "Tennis Playground", "Union Station", "Sewage Disposal", "Great Pond", "Swamp", "Norfolk Co", and "Plymouth Co". The map also shows various ponds such as "Whitman's Pond", "Knox's Pond", and "Great Pond". A north arrow is located in the bottom right corner, and the map is oriented with North at the top.

This topographic map, titled "FIGURE VI-4", depicts the South Keyport area. Key features include:

- Water Features:** Great Pond, Whitmans Pond, and several smaller ponds and streams.
- Roads:** RTE. 3, RTE. 18, and an INTERCHANGE.
- Proposed Well Site:** Indicated by a dashed line and labeled "WELL SITE".
- Geographic Labels:** Village Camp, Homestead, Reed Camp, Lovell Corners, Rest Areas, Fairgrounds, South Keyport, and Union.
- Infrastructure:** Sewage Disposal, Playground, and various utility lines.
- Orientation:** A north arrow is located in the bottom right corner.
- County Labels:** NORFOLK CO. and PLYMOUTH CO. are visible along the right edge.

FIGURE VI-4

Topographic map of the South Keyport area. The map shows the proposed well site (marked with a star) located near the intersection of RTE. 3 and RTE. 18. Key features include:

- RTE. 3**: A major road running horizontally across the upper middle of the map.
- RTE. 18**: A major road running horizontally across the lower middle of the map.
- WELL SITE**: Indicated by a star symbol near the intersection of RTE. 3 and RTE. 18.
- Geographical Features**:
 - Whitman's Pond**: Located to the northeast of the well site.
 - Knickerbocker Pond**: Located to the east of the well site.
 - Great Pond**: Located to the southwest of the well site.
 - Swamp**: Located to the southeast of the well site.
- Other Landmarks**:
 - Interchange**: Located near the intersection of RTE. 3 and RTE. 18.
 - South Keyport**: The town name is visible in the lower right quadrant.
 - Union Station**: Located in the lower right quadrant.
 - St. Francis Xavier Church**: Located near the center of the map.
 - Rest Areas**: Several rest areas are marked along the roads.
- Topography**: Contour lines indicate elevation, with higher elevations (up to 100 feet) shown in the northern and western parts of the map.
- Map Orientation**: A north arrow is located in the bottom right corner, pointing towards the top of the map.

FIGURE VI-4

Topographic map of the South Keyport area. The map shows the proposed well site (marked with a star) located near the intersection of RTE. 3 and RTE. 18. Key features include:

- RTE. 3**: A major road running horizontally across the middle of the map.
- RTE. 18**: A road running vertically through the center of the map.
- WELL SITE**: Indicated by a star symbol near the intersection of RTE. 3 and RTE. 18.
- Geographical Features**: Includes Great Pond, White Pond, and several smaller ponds and swamps.
- Settlements**: South Keyport is shown in the lower right, with various streets and buildings.
- Infrastructure**: An interchange is marked near the well site, and a railroad line runs along the left side of the map.
- Other Labels**: "INTERCHANGE", "SOUTH KEYPORT", "SWAMP", "NORFOLK CO. PLYMOUTH CO.", and a north arrow pointing towards the top right.

This topographic map, titled "FIGURE VI-4", depicts the South Keyport area. The map features contour lines indicating elevation, with labels such as "100", "150", and "200". Key roads are shown, including "RTE. 3" and "RTE. 18". A proposed "WELL SITE" is marked with a circle and labeled. Other landmarks include "Great Pond", "Whitman's Pond", "Lovell Corners", and "South Keyport". The map also shows "INTERCHANGE" and "Rest Areas". A compass rose in the bottom right corner indicates North (N). The map is bordered by "NORFOLK CO." and "PLYMOUTH CO." on the right side.

This is a detailed topographic map of the South Keyport area. The map features contour lines indicating elevation, with labels such as 100, 120, 140, 160, 180, 200, 220, 240, 260, 280, 300, 320, 340, 360, 380, 400, 420, 440, 460, 480, 500, 520, 540, 560, 580, 600, 620, 640, 660, 680, 700, 720, 740, 760, 780, 800, 820, 840, 860, 880, 900, 920, 940, 960, 980, and 1000. Key landmarks include Great Pond, White Pond, and various smaller ponds and swamps. The map also shows several roads, including RTE. 3 and RTE. 18, and an interchange. A proposed well site is marked with a circle and labeled 'WELL SITE'. Other features include a sewage discoloration area, a playground, and various buildings and structures. The map is oriented with North at the top, as indicated by a compass rose in the bottom right corner. The map is labeled 'FIGURE VI-4' in the top right corner.

This topographic map, titled "FIGURE VI-4", depicts the South Keyport area. The map features contour lines indicating elevation, with labels such as "100", "150", and "200". Key roads are shown, including "RTE. 3" and "RTE. 18". A proposed "WELL SITE" is marked with a circle and labeled. Other landmarks include "Great Pond", "Whitman's Pond", "Lovell Corners", and "South Keyport". The map also shows "INTERCHANGE" and "Rest Areas". A compass rose in the bottom right corner indicates North (N). The map is labeled "NORFOLK CO. PLYMOUTH CO." along the bottom edge.

[illegible][illegible]

VI SENSITIVE SITES, (Cont'd)

mixture of Sand and Sodium Chloride was the absolute minimum that could be applied. The installation of a closed drainage system and other engineering techniques are also being considered in this area, but no absolute solution has been developed yet.

Neponset Conservation Association has requested that the Fowl Meadow be included as a potential sensitive aquifer. The Department will investigate the impact of its snow and ice control activities on Fowl Meadow and will discuss the results with EOEa (Executive Office of Environmental Affairs) as requested by the Neponset Conservation Association.

As stated in Section B. 3., no special chemical treatment program for sensitive sites will be implemented by the Department of Public Works as this would create a hazardous situation by changing road surface conditions on contiguous stretches of roadway. By following the procedures outlined in Section III B. 1., the Department accomplished minimal salt usage by maximum monitoring.

The Metropolitan District Commission's water supply comes principally from Quabbin, Ware River and Wachusett Reservoir watersheds. There are access roads throughout these areas used principally for maintenance purposes. A Sand and salt mixture, at a sand:salt ratio of 40:1, is used on the roads within those reservoir and distribution

VI SENSITIVE SITES, (Cont'd).

areas. Also, in these areas, the salt is generally bagged until mixed with the sand, and some cases calcium chloride (at a 1:4 ratio with sand) is used at parking lots and manholes. Most of the salt used is not within the confines of the watershed. The roadways that require sand and salt applications have all their drainage diverted from their watersheds. A more detailed specification of salt and sand use sites is available from the Metropolitan District Commission.

At the request of the Massachusetts Department of Public Works, \$1.0 million was included in the State's Transportation Bond Issue for the construction of salt storage sheds by cities and towns. A notice of the availability of these funds was sent to all municipalities directing those interested in receiving funds to send requests to the Department. One of the major objectives of this storage shed building program is to minimize the possible environmental impacts resulting from the storage of deicing chemicals. Those municipalities having a public water supply with a sodium concentration of 20 mg/l or higher, the State's standard for drinking water, will receive primary consideration in the allocation of these funds. The final determination of eligibility will be made using the records of the Department of Environmental Quality

VI SENSITIVE SITES, (Cont'd)

Engineering's Division of Water Supply and by on-site inspection. Depending on the size of the salt storage shed required, the cost of each structure, not including lights or site preparation, ranges from \$24,000 to \$31,500.

VII BENEFIT-COSTS (Salt and the Environment)

Before the economics of this subject is presented, it is appropriate to address the impacts of salt use on the environment. Although many materials have been used in ice control, salt (sodium chloride) is the only material used over a sufficient period of time to establish a record of performance upon which to judge impacts. Relative to other materials, salt is cheap, available in large quantity, and has chemical and physical characteristics desirable for melting of snow and ice. No cheap, suitable substitute is available at the present time.

So much for the good features of the material, the undesirable aspect of the scale relates to salt pollution of the environment. Review of the literature directs attention to three references (1), (5), (20) on this subject matter. The following is a summary of the findings contained therein:

1. Salt enters the environment by deposition through the hydrologic cycle and falls on the surface of the United States as rainfall. Salt is present in seawater and minerals. In the Northern snow belt States, salt also enters the environment through use of deicing chemicals in the snow removal process.
2. Salt enters into solution with water and penetrates unpaved land areas and enters lakes, ponds, rivers and reservoirs. Salt solutions penetrate to groundwater and reach aquifers. It is from the aquifer and reservoirs that cities and towns draw their water supplies. Salt impacts these water supplies and human, animal, and vegetable life is effected by excessive concentrations.

VII BENEFIT-COSTS (Salt and the Environment) Cont.

3. Salt in solution from melting snow and ice, runs along the surface and enters wetlands, ponds, and lakes. Animal life and fish life that habitate on these water bodies, are effected adversely by increased salt intake.

4. Rainfall dissolves salt from uncovered or unsultably covered salt storage oiles. The salt solution runs off and pollutes land and water thereby contributing to the chronic or toxic effects of large salt concentrations on animal, fish, and human life.

In all this discussion, it is well to keep in mind that the sodium part of the salt is the culprit leading to the medical abnormalities in plant, animal, and human life. There are sources other than salt for sodium pollution. Consider water treatment with sodium hydroxide, drainage from cesspools and septic tanks, leaching from sanitary land fills, and industrial plant discharge in water bodies or at land dumping sites.

In conclusion, it must be emphasized that research is necessary to quantify the concentration of salt and the manner in which this material distributes itself in the environment with time. The Department and the U. S. Department of the Interior, Geological Survey are conducting an on-going research project to study this problem. The test results will not be available for inclusion in this report. It is anticipated that this research effort will answer some of the questions on distribution of salt in the environment. The knowledge so gained should add to the operational skill in applying salt rates with minimum harm to the environment. (1) (pp.320-321 incl.)

VII BENEFIT-COSTS (Salt and the Environment) Cont.

Having decided to use salt for snow and ice control, the next logical approach is to discuss methods available to measure and control its application. The benefit-cost method would be an ideal tool to accomplish this desirable end result. It has been recognized by highway officials as effective for decision-making purposes where there are well defined alternatives. In the case of snow and ice control, benefit-cost analysis could really be effective if relationships were found between salt use versus gross benefits, salt use versus environmental damage, and salt use versus plowing effort costs. Present state of the art is such that no information is available that is necessary for this type of benefit-cost analysis.

The Department has done some work in relating salt use with cost of plowing effort within its test roads program (refer to Section III A.1.). Salt rates were varied from 100 lbs-300 lbs. per lane mile over several specified test sections of roadway. Costs were kept on plowing effort corresponding to salt rate applied. The summarized results have not been correlated in any manner for presentation in a cost-benefit analysis. Additional work along these lines would be very helpful in formulating a method of arriving at a most economical and environmentally acceptable salt use application rate. The method would entail plotting salt use rates versus cost of plowing effort. That salt use rate would be selected for the minimum plowing cost. The inherent flaw in this approach is that there is no tie in of salt use with benefits and environmental damage costs. It is a step in the right direction to accumulate data from which

VII BENEFIT-COSTS (Salt and the Environment) Cont.

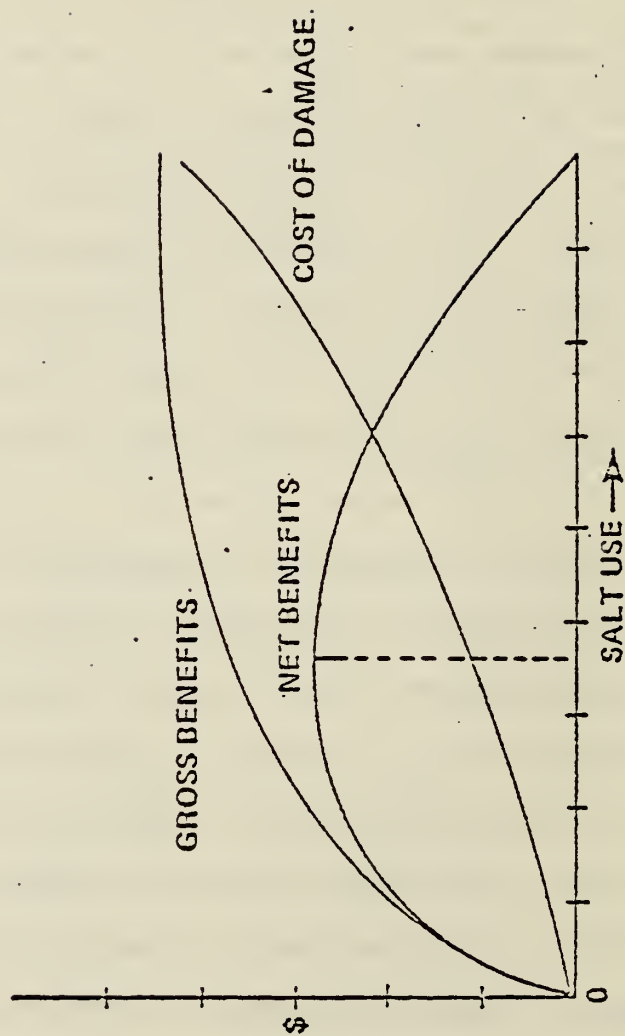
useful correlation may result.

Another approach to the problem of determination of optimum salt rate use is to find a correlation between salt use and benefits; salt use and environmental damage costs and plot the benefits versus the costs for each salt application rate in a manner as shown on Figure VII-1. The net benefits (benefits minus costs) would be plotted versus salt application rates. That salt application rate corresponding to the maximum net benefit would be selected. Since the essential data correlations are unavailable either in the literature or snow and ice field experience records of the Department, this method cannot be implemented. It is a good method and research in the future might well be directed to correlate the essential information for its application.

The method presented in this report is a compromise. It will not select an optimum salt use rate. It is salt related only to the extent that the Department policy is based on a fixed salt use rate in a bare road level of service within a budget constraint. Benefits and costs are listed rather than placed in any ratio or formula. It is intended to show the magnitude of the impacts involved in the environment and the benefits derived to users of highways. As many as possible known benefits and costs are listed whether quantifiable or not. Future reports should upgrade these environmental elements to study correlations with reduced yearly salt rates. It will be noted that the gross benefits exceed the gross costs by a wide margin. No special significance is to be attached to this and no way is it intended to justify any particular salt use application rate. Salt is not a variable in this economic analysis.

FIGURE VII-1

COSTS, GROSS BENEFITS, AND NET BENEFITS OF SALT
AS A FUNCTION OF SALT USAGE LEVEL



VII BENEFIT-COSTS (SNOW AND ICE CONTROL)

This section analyzes the benefit-costs of snow and ice control. It relates classes of environmental and non-environmental impacts and places emphasis on what impacts are quantifiable, quantifiable when properly documented, and not quantifiable. Those impacts that are quantifiable are called "receptors". The receptor is defined as any element of benefit or cost for which economic data is available on an annual basis and quantifiable.

The following is a summary of benefits and costs to be discussed in following sections:

A. Benefits - Non Environmental - Quantifiable

1. Savings in Workers Absenteeism (\$813,000,000) Section VII A.1.
2. Savings in Lost Gross State Product (\$624,000,000) Section VII A.2.

B. Benefits - Non Environmental - Quantifiable When Properly Documented

1. Traffic Accidents On Snow Days Versus Non-Snow Related Days.
Section VII B.1.
2. Benefits to Commuters Traveling to Work by Bus. Section VII B.2.
3. Benefits To Truck Drivers Moving Goods. Section VII B.3.
4. Savings in Dollar Value of Commercial Goods Moved By Common Carrier. Section VII B.4.
5. Reduced Time For Police and Fire Vehicles In Response To Calls.
Section VII B.5.
6. Reduced Time For Ambulances In Response To Emergency Calls.
Section VII B.6.
7. Travel Time Savings For Auto Commuters. Section VII B.7.
8. Travel Time Savings In Shopping, Recreation, Social And Public Trips. Section VII B.8.
9. Vehicle Operating Costs. Section VII B.9.

VII BENEFIT-COSTS (SNOW AND ICE CONTROL)

C. Benefits - Non Environmental - Not Quantifiable

1. Inconvenience of Cancelling or Postponing Trips. Section VII C.1.
2. Land Use and Urban Development. Section VII C.2.
3. Comfort and Convenience. Section VII C.3.
4. Safety on the Highways. Section VII C.4.

D. Costs - Environmental - Quantifiable

1. Corrosion of Vehicles (\$110,500,000) Section VII D.1.
2. Damage to Highways and Highway Structures. (\$2,250,000)
Section VII D.2.
3. Damage to Drinking Water Supplies. (\$129,000,000) Section
VII D.3. Replacement of Drinking Water Wells (\$3,750,000)
4. Plowing of Snow and Ice with Salting and Sanding. (\$13,049,000)
Section VII D.4.

E. Costs - Environmental - Quantifiable when Properly Documented

1. Damage to Utilities. Section VII E.1.
2. Damage to Trees, Bushes, Grass. Section VII E.2.

F. Costs - Environmental - Not Quantifiable

1. Damage to Streams, Rivers, Ponds, Lakes, Reservoirs, Section VII F.1.
2. Damage to Wildlife and Fishlife. Section VII F.2.
3. Damage to Air Quality by use of Salt and Sand. Section VII F.3.
4. Damage to Air Quality by use of Snow Plows and Congested Traffic.
Section F.4.
5. Damage to Sand Extracting Sites with Aesthetics Involved.
Section F.5.
6. Additional Energy and Resource Usage. Section F.6.

VII A. Benefits-Non Environmental-Quantifiable

I. Savings In Worker's Absenteeism from Business and Manufacturing Industry for 1975-1976 Winter.

Experience is drawn from 5 Massachusetts Interstate Highways.

Referring to Table VII D-1, note that it is determined from computerized data on average daily traffic (ADT) during the winter of 1975-1976, November to March. There were fifty-two (52) weekday snow storms affecting approximately twenty-six (26) percent of the vehicle-miles in home to work travel. Using highway statistics, P.111-3, 1975 FHWA (11), average daily travel in Massachusetts is 80,000,000 vehicle-miles based on 365 days.

Average daily passenger travel is 79% of 80,000,000=63,200,000 vehicle-miles. Getting to work is 17% of 63,200,000=10,700,000 vehicle miles.

Average daily number of passengers work bound by automobiles is determined by dividing 10,700,000 vehicle-miles by the daily length (10.2 miles) and multiplying by the number of passengers per car (1.4)=10,700,000 x 1.4/10.2=1,500,000 (see Table VII D-2 for calculations and references).

The fifty-two (52) snow storms during the winter of 1975-1976, calculate to a dollar value of \$813,000,000. This benefit is the maximum as it is based on a worker's delay or absenteeism for one day from business or industry if snow and ice control methods had not taken place. Under average conditions it is assumed snow plowing with salt deicing, would result in a reasonably safe for travel condition. Workers reach their destination without loss of pay.

TABLE VII D-1

% Vehicle - Miles Travel on Mass. Interstate Highways Affected by Snowstorms for the Winter 1975-1976

<u>Interstate Rte. No.</u>	<u>Miles</u>	<u>ADT</u>	<u>Vehicle Miles</u>	<u>No. Times Snow Affected</u>	<u>Total No. Snowstorms</u>	<u>% Snow Affected</u>	<u>Vehicle Miles Affected</u>
91	53.81	19105	1,028,040	1	64	1.6	16,449
95	49.55	9795	485,342	25	64	39.1	189,769
195	25.45	15650	398,292	0	64	0	0
290	20.63	29366	605,820	6	64	9.4	56,947
495	87.77	16706	1,466,205	33	64	51.6	756,603
Totals			3,983,779				1,019,768

Calculation

Column 8 ÷ column 4 x 100 = % vehicle - miles affected by snowstorms

1,019,768 x 100 = 25.6% (call 26%)

References

Column 3. traffic data, Mass. Department of Public Works, Transportation & Planning.
 Column 4 = Column 2 x Column 3
 Column 5 = traffic data counts, Mass. Department of Public Works, Transportation & Planning
 Column 6 = weather data from Northeast Weather Services, Inc., Bedford, MA

TABLE VII D-2

Savings in Worker's Absenteeism from Business and Manufacturing Industry for the 1975-1976 Winter.

	<u>Millions</u>
1. Average daily vehicle-miles travel in Massachusetts (<u>14</u>)	80
2. Passenger travel, average daily (79% of total vehicle-miles) (<u>15</u>)	63.2
3. Vehicle-miles getting to work (17% of line 2.) (<u>16</u>)	10.7
4. Number of passengers getting to work by automobile, average daily (<u>17</u>)	1.5
5. <u>Workers absenteeism if roads were not usable one day,</u> dollars, \$813,000,000	

Calculations

4. Line 3. ÷ Average trip length (miles) × number passengers
per car home to work

$$\frac{10,700,000}{10.2} \times 1.4 = \underline{1,500,000 \text{ passengers home to work}}$$

5. Line 4. × 52 (Snowstorms excluding Saturdays and Sundays) × 26%
(vehicle-miles affected by snowstorms) × \$5.01 (average hourly
earnings of production workers in Massachusetts, February, 1977 (18))
× 8 hours = \$813,000,000.

2. Savings in Lost Massachusetts Gross State Product From Business and Industry For The 1975-1976 Winter

The concept of the Gross State Product (GSP) is reported in a study by Elizabeth A. Berman, Federal Reserve Bank of Boston (12). The Gross State Product for Massachusetts for 1975 is \$39,820,000,000. On a daily basis dividing by 365, this amount is \$109,000,000. The economic loss suffered by the State of Massachusetts is related to the sixty-four (64) snowstorms in 1975-1976 during the months of November to March as reported by Northeast Weather Services Corp. (13). In the study made on Massachusetts Interstate Highways (Table VII-D-1), approximately 26% of the snowstorms affect traffic bound for manufacturing and business. The economic impact is calculated as 64 snowstorms x .26 snow impact factor x \$109,000,000 average daily Massachusetts Gross Product = \$1,437,280,000 (call \$1,437,000,000). The amount of \$1,437,000,000 includes workers rates and salaries. To avoid double counting, this figure is reduced by \$813,000,000 which has already been accounted for under Section VII-A.1. The final sum is \$1,437,000-\$813,000,000 = \$624,000,000. (see Table VII D-3 for calculations)

VII B. Benefits-Non-Environmental-Quantifiable When Properly Documented

1. Traffic accidents on Snow Days Versus Non-Snow Related Days.

Analysis was made of computerized data on Massachusetts Interstate highways compiling accidents per 1,000,000 vehicle-miles. The data covered six winter periods from 1970-1971 to 1975-1976 during the months November to March. Corrections were introduced for the reduced ADT on snow related days. The results are not reported as it was found that the

TABLE VII D-3

Savings in Lost Massachusetts Gross State Product from Business and Industry for the 1975-1976 Winter.

	<u>Millions</u>
1. Average daily vehicle-miles of travel in Massachusetts (14)	80
2. Passenger travel, average daily vehicle-miles (79% of total vehicle-miles) (15)	63.2
3. Vehicle-miles earning a living, 21% of daily passenger travel (16)	13.3
4. Number passengers traveling by automobile (17) as work and business related, average daily	1.8
5. <u>Gross State Product lost during 64 snowstorms 1975-1976,</u> <u>dollar, \$624,000,000</u>	

Calculations

4. Line 3. ÷ 10.2 miles (average trip length) x 1.4
(average occupancy per trip)
5. Line 4 x number of snowstorms x % snowstorms affecting entire state
x daily gross state product ÷ total employment non-farm industry
and business.

$$1,800,000 \times 64 \times .26 \times \$109,000,000 \times \frac{1}{2,272,000} = \$1,437,280,000$$

$$\$1,437,280,000 - \$813,000,000 = \$624,280,000 \text{ (call } \$624,000,000)$$

(TABLE VII-D-2)

VII B. Benefits-Non Environmental-Quantifiable When Properly Documented

1. Traffic Accidents on Snow Days versus Non-Snow Related Days

evidence is inconclusive and definitive dollar values for differences in experiences could not be determined. This receptor while not yielding effective data for the years investigated will be re-examined each winter and included in the benefit-cost tabulation when values accrue. For this and the following items there is no data to quantify.

2. Benefits to Commuters Traveling to Work by Bus

Bus travel benefits accrue from roadways free of ice and snow. Commuters arrive at work on time. Delays would result in worker's losses.

3. Benefits to Truck Drivers Moving Goods

This benefit relates to time savings to truck drivers in moving goods on snow and ice free roadways.

4. Savings in Dollar Value of Commercial Goods Moved by Common Carriers

Commercial goods not delivered by common carriers due to snow and ice on the highways would result in a loss to industry and business.

5. Reduced Time for Police and Fire Vehicles in Response to Calls

Snow and ice removal from highways benefit police and fire vehicles response to calls.

6. Reduced Time for Ambulance in Response to Emergency Calls

Time saving in ambulance response over plowed roadways. Benefits relate to dollar value assigned medical on-call work.

VII B. Benefits-Non-Environmental-Quantifiable When Properly Documented

7. Travel Time Savings for Auto Commuters

This impact relates to an increase in travel time due to snow and ice conditions.

8. Travel Time Savings in Shopping, Recreation, Social and Public Trips

These types of trips would be cancelled or postponed, but emergency trips could not be rescheduled.

9. Vehicle Operating Costs

Vehicles operating in snow and ice have poor fuel efficiency.

Would involve testing of vehicles under salt and no salt conditions.

VII C. Benefits-Non-Environmental-Not Quantifiable

1. Inconvenience of Cancelling or Postponing Trips

This benefit relates to lack of mobility on roadways covered with snow and ice. This impacts motorists who are not free to capture opportunities in business, industry, and social pursuits.

2. Land Use and Urban Development

Snow and ice free roadways encourage vehicle travel and foster land-use all year around. Land development will take place. Mobility is a benefit for urban suburban roadside activity.

3. Comfort and Convenience

This benefit measures the motorist's freedom from concern for any skidding possibilities, bumps, hollows, and close attention to driving.

VII C. Benefits-Non-Environmental-Not Quantifiable

4. Safety on the Highways

This benefit measures the motorist sense of security from accidents on roadways free of ice and snow and properly sanded.

Empirical data is not available to quantify.

VII D. Cost-Environmental-Quantifiable

1. Corrosion of vehicles

Murray and Ernst, Abt Associates, Inc., (2) estimate the cost effects of salt damage to vehicles (75%), highway structures (18%), water/vegetation (7 1/2%) and utilities (0.4%).

There are four (4) basic categories reflecting cost due to corrosion of vehicles: (1) The cost of protective surfaces as add-ons by either the owner or the manufacturer; (2) The cost of repairs to the vehicle as a result of the corrosion; (3) Loss in economic value of the vehicle due to corrosion; (4) Cost of accidents related to corrosion of the vehicle. Murray and Ernst (2) summarize by pointing out there is great difficulty in measuring costs for categories (1), (2), and (4) respectively. The authors concentrate on category three (3) which is the major cost and present a linear regression analysis. This methodology links depreciation of vehicles related to salt damage in the pertinent environment. The net result for the corrosion of vehicles in Massachusetts estimated for the year 1973 based on registration of 2,653,000 vehicles is \$90,720,000. An average used car price of \$1500 is assumed. The cost data divides out to economic loss per vehicle of \$34, or approximately better than 2% of the average used car price. A search of the literature by Murray and Ernst

VII D. Cost-Environmental-Quantifiable

1. Corrosion of vehicles

(2), Madden (3) and reported in Brenner and Moshman (4) reveals no reliable cost data available through studies or "actual conditions" experiments.

The empirical method by Murray and Ernst is the best concept at the present time to arrive at a reasonable cost estimate of the damage to vehicle registration of $3,250,000 \times \$34.00 = \underline{\$110,500,000.}$

2. Damage to Highways and Highway Structures

It is the consensus of authorities that salt damage to highways is small. Salt damage to bridge decks is a major cost item. All available cost data is reviewed and presented in reports by Murray and Ernst (2), and Brenner and Moshman (4).

In Massachusetts it is estimated there are 200,000 square yards of exposed concrete bridge decks on the interstate system out of a total of 1,000,000 square yards. Since there are an estimated 3,000,000 square yards of bridge decks of all types statewide and using the ratio $200,000/1,000,000 \times 3,000,000 = 600,000$ square yards exposed concrete decks statewide (estimated). Without salt used for deicing, concrete decks are expected to have a life of 40 years. With salt for deicing, concrete decks have a reduced life estimated as twenty years. The salt corrosion rate is estimated as 5% over the twenty year span of life. Corrosion of concrete bridge decks comes about through salt solutions entering through cracks and corroding reinforcing steel. The net result is the spalling of chunks of concrete deck and the need for replacement of the deck surface. Annual deck replacement cost is estimated $600,000 \times \$75.00$ per square yard = \$45,000,000.

VII D. Cost-Environmental-Quantifiable

2. Damage to Highways and Highway Structures

Annual salt erosion of concrete decks is estimated as $\$45,000,000 \times .05 = \$2,250,000$.

3. Damage to Drinking Water Supplies

Damage to drinking water supplies consist in raising the level of sodium (Na^+) concentrations above limits, in parts per million (ppm), considered acceptable by the Massachusetts Executive Office of Environmental Affairs (EOEA). During the winter of 1976 Massachusetts Cities and Towns reported approximately 150 public drinking water wells with a sodium concentration (Na^+) of twenty (20) ppm or higher. This value is considered by health authorities as a cut-off point beyond which the consumption of such water may result in serious medical problems such as hypertension, and high blood pressure. What empirical data there is, indicates that in Massachusetts approximately (27%) of the Towns and Cities have drinking water from wells with a high sodium content, 20 ppm or higher. The percentage of the population from those Cities and Towns with reference to statewide census in the year 1975 is reported as 1,405,903 and includes 80 Cities and towns. Using a percentage of 2.5% for the year 1976 for growth extrapolation, the number of people affected by high sodium drinking water is estimated as approximately 1,412,845. Using cost figures from private organizations supplying bottled drinking water (9), it costs 25 cents per person per day or \$91.00 per year. It is assumed that bottled water would be used for drinking and cooking and that the well water would be suitable for all other uses. The cost of supplying bottled drinking water is estimated in 1976 as $\$1,412,845 \times \$91.00 = \$128,568,890.00$ (call \$129,000,000).

VII D. Cost-Environmental-Quantifiable

3. Damage to Drinking Water Supplies

The Burlington, Massachusetts study in the 1960's by the U. S. Geological Survey indicated that 40% of the contamination problem of the wells was due to the town's application and storage of salt, 15% from the neighboring town of Lexington, 15% from septic tanks and industry, with the remaining 30% from salting of Route 123 by the Massachusetts Department of Public Works. The State expects to reduce this problem on a statewide basis by taking into consideration the following measures: (1) installation of special drainage systems for salt runoff from highways near well sites and drinking water supplies; (2) selection of new public drinking water well sites away from highway drainage areas; (3) planning locations of new highways while cognizant of water supplies in the area; (4) building salt sheds for storage of deicing chemicals and directing all cities and towns to do likewise; (5) better training and education of personnel statewide in the use of deicing chemicals for snow and ice removal; (6) reducing salt applications for deicing roadways by a managed salting policy; and (7) cities and towns will be advised to place wells away from highway drainage areas.

There are approximately 150 gravel backed public drinking wells in Massachusetts with a high sodium content. Replacement cost for these wells is estimated $150 \times 50'$ (av. depth) $\times$ \$500/ft = \$3,750,000.

4. Plowing of Snow and Ice with Salting and Sanding

Plowing and spreading costs are upgraded to seasons 1975-1976 and 1976-1977 by the Massachusetts Department of Public Works, Maintenance

VII D. Cost-Environmental-Quantifiable

4. Plowing of Snow and Ice with Salting and Sanding

Division (19). It is a summation of plowing sand and chemical application, snow fence, cleaning waterways, ramps, bridges, snow removal, sand removal, sand removal, and other inclusive road control. Total cost of the Statewide operation is \$13,049,000.00 for the 1975-1976 season.

VII E. Costs-Environmental-Quantifiable When Properly Documented

1. Damage to Utilities

Damage to underground cables and electric utility lines is summarized in 5.6, page 88, Murray and Ernst Report (2). The literature does not report empirical data upon which to build up a case in Massachusetts in a quantifiable manner. However, the experience in New York by Conn. Edison points to the salt effects on power lines as a substantial cost in the benefit-cost equation.

2. Damage to Trees, Bushes, Grass

Damage to trees, bushes, and grass result from the effects of de-icing salts that runoff from highways. The sodium (Na^+) ion interferes with the process by which a plant receives its food. It affects the osmotic balance and the water intake of plants. It assists in deterioration of the soil itself making it less permeable and absorbent. Very little data is available on which to base an empirical cost analysis. Only the experiences in the State of New Hampshire (5), Winchester (6), and Newton, Mass. (7) are reported. Dr. Holmes, University of Mass., states: "A 7 year test on applications of sodium chloride (NaCl) and calcium chloride (CaCl_2) to the sites of Maple, oak, hickory, black birch, ash and white pine indicates that winter road salting probably does no great harm to

VII E. Costs-Environmental-Quantifiable When Properly Documented

2. Damage to Trees, Bushes, Grass

deciduous trees in Massachusetts. (22)

VII F. Costs-Environmental-Not Quantifiable

1. Damage to Streams, Rivers, Ponds, Lakes, Reservoirs, Aquifers

Deicing salts would have little effect on large streams and rivers because of the high rate of flow and the dilution factor. Smaller streams and rivers could be seriously affected with the flow rate and roadway runoff as factors. Ponds, lakes and reservoirs are stationary water bodies with little intermix of the water layers with depth contributing to the process of aging or eutrophication when large salt concentration enter. An additional contamination results when roadway salt flows into fresh waters and triggers the release of mercury and other toxic heavy metals (which may be in the bottom sediment) (8).

2. Damage to Wildlife and Fishlife

Damage to marine and aquatic life in ponds, lakes, and reservoirs could be serious from roadway salt used for deicing and the resultant runoff into those water bodies. Heavy salt concentrations are likely to build up in land locked water bodies where there is little mixing and insignificant dilution.

3. Damage to Air Quality by Use of Salt and Sand

It has been reported In Southeastern Massachusetts that air pollution may be caused by the stirring up of salt and sand by cars, trucks, and buses (10). There is an apparent trade-off necessary between the rates of salt and sand applications to contain the particulate matter in the air within acceptable standards.

VII F. Costs-Environmental-Not Quantifiable

4. Damage to Air Quality by Use of Snow Plows and Congested Traffic

5. Damage to Sand Extracting Sites With Aesthetics Involved

Sand pit sites are left unattractive after extraction of the resource for sanding highways. Additional work must be done in landscaping to acceptable standards.

6. Additional Energy and Resource Usage

Operation of vehicles for snow and ice plowing, salting, and sanding. Operation of vehicles in dense traffic due to poor road conditions. Movement of vehicles on snow and ice road surfaces with increased usage of fuel. Depletion of sand resources for use in sanding roadways.

VII G. Conclusions

In summary, the methodology used in calculation of receptors for benefit-costs reflects the state of the art in research and development on snow and ice at the present time. It is expected that future studies in the field, such as the U. S. Corps of Engineers Cold Regions Research and Engineering Laboratories (4) (TISA p.35) will supply good experimental data on which to base a sound and environmentally acceptable salting policy. Backed with FHWA funds, this project will strive to determine optimal salt rates (quantity, duration and frequency) for the entire range of typical snow and ice conditions. Laboratory and field tests will be conducted. Meanwhile until those research results are available and reviewed, the Massachusetts Department of Public Works will make decisions based upon field conditions. Highways will be salted to keep traffic moving in a safe and mobile manner working within the constraints of the snow and ice budget.

References

- (1) "Draft Environmental Impact Report for the Snow & Ice Control Program", Massachusetts Department of Public Works, June 1976.
- (2) "An Economic Analysis of the Environmental Impact of Highway Deicing", by Donald M. Murray and Ulrich F.W. Ernst, EPA-600/2-76-105, May 1976.
- (3) "The Use of Salt in Ice and Snow Control in Rochester, A cost Benefit Study", System Analysis Program, Working Paper Series No.7124, University of Rochester, New York, May 1971.
- (4) "Benefits and Costs in the Use of Salt to Deice Highways", by Robert Brenner and Jack Moshman, TISA, November 1976.
- (5) "Some Effects of Deicing Chemicals on Roadside Trees", Highway Research Record 425, Highway Research Board, 1973.
- (6) "Deicing Salts and the Environment", Habitat School of Environment for the Massachusetts Audubon Society, Belmont, Massachusetts, 1972.
- (7) "Salting Away Many Things", Chemistry 46:20-21 (1973).
- (8) "Release of Mercury from Contaminated Fresh Water Sediments by the Runoff of Road Deicing Salts", Science, Vol.175, pp 1142-1134, 1972.
- (9) Belmont Springs Water Co., Belmont, Massachusetts
- (10) Brockton Daily Evening Enterprise, Saturday, April 16, 1977
- (11) Highway Statistics, FHWA, Section 3, Local Highway Finance, 1975.
- (12) New England Gross Product, 1955-1975, Elizabeth A. Berman, Federal Reserve Bank of Boston.
- (13) Northeast Weather Services, Inc., Bedford, Massachusetts.
- (14) Highway Statistics, FHWA, Section 3, p.111-3 1975
- (15) Highway Statistics, FHWA, Page 67, 1974
- (16) National Personal Transportation Study, FHWA, Report No.10, Page 13, 1/2% Home to Work Travel.

References

- (17) National Personal Transportation Study, FHWA, Report No.8, Page 89,
Report No.10, Page 17.
- (18) Massachusetts Employment Security Employment Statistics, February, 1977.
- (19) Massachusetts Department of Public Works, Maintenance Division, fiscal
1976 up-grading of plowing and sanding costs by computer printout.
- (20) Road Salt Use and the Environment by W.H. Walker and F.D. Wood,
Illinois State Water Survey and The Salt Institute.
- (21) Letter dated November 21, 1977 from the Metropolitan District
Commission.
- (22) Salt Injury To Trees by Francis W. Holmes. Shade Tree Laboratories;
University of Mass., Amherst, Mass. October 1961.

VIII PARTICIPATION

VIII A. Snow & Ice Control Task Force

After comments were received from the Massachusetts Executive Office of Environmental Affairs and others concerning the November 1974 Draft Environmental Impact Report for the Snow & Ice Control Programs the Commissioner of the Massachusetts Department of Public Works formed the Snow & Ice Control Task Force. This Task Force meets on a regular basis and is comprised of various state agency representatives, regional planning agencies, concerned environmental groups and the general public. Through a cooperative effort the goal of this Task Force is to arrive at a highway deicing policy which will be beneficial to the citizens of the Commonwealth while taking into consideration safety, economic factors and environmental concerns. The Task Force is chaired by the Environmental Engineer of the Department of Public Works and has assisted in the development of this Environmental Impact Report.

A list of members of the Task Force (not including private citizens) follows:

State Agencies

- Massachusetts Department of Public Works
- Metropolitan District Commission
- Massachusetts Turnpike Authority
- Executive Office of Environmental Affairs
- Department of Public Health
- Department of Environmental Quality Engineering
- Department of Environmental Management
- Massachusetts State Police
- Office of State Planning
- Regional Planning Agencies

VIII A. Cont.

Environmental Groups

Charles River Watershed Association
Conservation Law Foundation
Habitat
Lake Cochituate Watershed Association
Massachusetts Audubon Society
Massachusetts Forest and Park Association
Massachusetts Public Information Research Group
Neponset Conservation Association
Norumbega Association

Other Interested Parties

Abt Associates, Inc.
Arthur D. Little Co.
Massachusetts Highway Users Federation
The Salt Institute

The attendance at the meetings averages between twenty-five and thirty-five people. A list of the meeting dates with a brief synopsis follows: The meetings prior to August 1976 were covered in the draft environmental impact report.

August 20, 1976

The major items of discussion were:

- Notice of public hearing on draft environmental impact report.
- Test Section Report.
- Various studies, including new technologies, new designs, environmentally sensitive areas and legal considerations.

October 13, 1976

Representatives of Connecticut's Department of Transportation, Department of Health and Department of Environmental Protection discussed their experiences with Connecticut's Snow and Ice Control Program in relation to their sodium standard of 20 ppm.

VIII A. Cont.

November 18, 1976

Secretary of Environmental Affairs, Evelyn F. Murphy's Statement concerning the draft environmental impact report was discussed. The procedures to be followed in the preparation of the final environmental impact report were also outlined.

December 16, 1976

Mr. Donald Murray of Abt Associates of Cambridge, Massachusetts and Robert Brenner, Ph.D of the Institute for Safety Analysis of Washington, D. C. discussed various impact of highway deicing. Mr. Murray is co-author of "An Economic Analysis of the Environmental Impact of Highway Deicing", a report by Abt Associates, sponsored by the Environmental Protection Agency. Dr. Brenner is co-author of "Benefits and Costs in the Use of Salt to Deice Highways", a report by the Institute for Safety Analysis sponsored by the Salt Institute.

January 13, 1977

Mr. Larry Thomas, a Washington, D. C. attorney and Mr. Alan Gottlieb an attorney with the Massachusetts Department of Public Works discussed the legal aspects of highway maintenance, with emphasis on snow and ice control practices. Mr. Thomas was formerly with the Transportation Research Board and author of an extensive study on the legal aspects of snow and ice control. Mr. Gottlieb is author of a section in the Draft Environmental Impact Report for the Snow and Ice Control Programs which also deals with the legal implications of snow and ice control practices.

VIII A. Cont.

February 17, 1977

At this meeting the major items of discussion were:

- The designation of a sodium standard.
- Identification of environmentally sensitive areas adjacent to State highways.
- City and Town use and storage of salt.
- The Cambridge Reservoir Study which concerns the intrusion of highway deicing salt into the reservoir which is adjacent to Routes 128 and 2.

March 24, 1977

At this meeting the major items of discussion were:

- The designation of a sodium standard.
- Identification of environmentally sensitive areas adjacency to State highways.
- Educational efforts of the Massachusetts Department of Public Works toward city and town use and storage of deicing chemicals.
- Private Water Supplies, possible contamination from highway deicing salts.

April 21, 1977

At this meeting the major items of discussion were:

- The proposed "Drinking Water Regulations of Massachusetts" with particular attention to the sodium standard.
- Environmentally sensitive areas adjacent to State highways.
- Cambridge Reservoir Study.
- Private Water Supplies, possible contamination from highway deicing salts.

VIII A. Cont.

- Regulations for municipal salt storage.
- Education of driving public for reduced salting policy.

May 19, 1977

Professor Robert L. Meserve of Northeastern University's College of Engineering discussed the use of sodium compounds in water treatment and some possible alternatives to their use. Also other compounds used for water treatment were covered along with their possible effects.

Other items of discussion were:

- The proposed "Drinking Water Standards of Massachusetts".
with particular attention to the sodium standard.
- Environmentally sensitive areas adjacent to State highways.
- Cambridge Reservoir Study.
- Private Water Supplies, possible contamination from highway deicing salts.
- Regulations for municipal salt storage.
- Education of driving public for reduced salting policy.

June 16, 1977

Copies of the testimony of Profession J. Carrell Morris presented at a public hearing held in Boston on April 12, 1977 regarding the "Drinking Water Regulations" were distributed. Also distributed were copies of the memorandum to Commissioner Fielding of the Department of Public Health from the "Ad Hoc Advisory Committee" regarding recommended

VIII A. Cont.

sodium levels. Other major items of discussion were the same as those covered at the May 19th meeting excluding the discussion by Professor Meserve.

VIII B. Public Hearing

A Public hearing on the Draft Environmental Impact Report for the Snow and Ice Control Programs of the Massachusetts Department of Public Works, the Metropolitan District Commission, the Massachusetts Turnpike Authority and the Massachusetts Bay Transportation Authority was held on Wednesday, September 15, 1976 at the Massachusetts Department of Public Works District Four Headquarters in Arlington. The purpose of the public hearing was to provide an opportunity for public comments on the draft report. All comments at this public hearing were reviewed and considered in the preparation of this final report.

Publicity for the hearing was handled by the Public Information Office of the Massachusetts Department of Public Works. Notice of the Public Hearing appeared in the following newspapers on September 1st and 13th.

Cape Cod Standard Time
Berkshire Eagle
Fall River Herald News
New Bedford Standard Times
Salem Evening News
Newbury Daily News
Lynn Item
Lawrence Eagle Tribune
Springfield News

Hampshire Gazette
Lowell Sun
Worcester Telegram & Gazette
Fitchburg Sentinel
Boston Record American
Brockton Enterprise
Dedham Transcript
Quincy Patriot Ledger
Recorder Publishing Co.
(Greenfield)

VIII B. Cont.

The notice appeared in the Boston Globe on September 8th and 13th.

Nineteen people were in attendance, thirteen of these being Massachusetts Department of Public Works personnel. The Stenographic Record of this public hearing is available from the Environmental Section of the Massachusetts Department of Public Works, 100 Nashua Street, Boston. The following are summaries of the pertinent statements from this hearing.

Evans C. Hawes, Department of Environmental Management and a member of Snow & Ice Control Task Force - feels that the draft is a "pretty good report".

Judith Pickett, Conservation Law Foundation and a member of Snow & Ice Control Task Force - the environmental damage which is of primary concern involves groundwater contamination and human health, these areas are not adequately covered in the report. The report is also seriously deficient for a number of other reasons.

Flora Epstein, Charles River Watershed Association and a member of Snow & Ice Control Task Force - concerned about contamination of water supplies in watershed, especially the Cambridge Water Supply.

Francis H. Carr, Snow & Ice Control Engineer, Massachusetts Department of Public Works and a member of Snow & Ice Control Task Force - in response to a question from the floor, briefly discussed salt storage sheds, application of salt, calibration of equipment and the purchase of new equipment.

VIII B. Cont.

Deborah Howard, Massachusetts Audubon Society and a member of Snow & Ice Control Task Force - feels a draft report is seriously deficient in several areas, of major concern is the sodium contamination of water supplies.

VIII C. Other

The Massachusetts Department of Public Works is currently participating in a study of the intrusion of deicing chemicals into the Cambridge Reservoir, which is located adjacent to Routes 128 and 2. This study, which was proposed by Norumbega Association, is a cooperative effort of the Department of Public Works, the Department of Environmental Quality Engineering, the City of Cambridge, and Norumbega Association with the assistance of the Waltham League of Women Voters, the Lexington Conservation Commission and the Lincoln Conservation Commission. For a more detailed explanation of this study, refer to Section VI of this report.

The Massachusetts Department of Public Works has instituted a Snow and Ice Control Media Campaign, which is being coordinated with the Governor's Highway Safety Bureau. The purpose of this is to urge the public to drive only when necessary during winter storm periods. If driving is necessary the use of extreme caution is stressed. The objective of the program is that with less travel there will be less need for the use of deicing chemicals and consequently any environmental impacts

VIII C. Cont.

resulting from snow and ice control will be minimized. Agencies involved in this effort, other than the Massachusetts Department of Public Works, are the:

Massachusetts Turnpike Authority
Metropolitan District Commission
Massachusetts Bay Transportation Authority
Massachusetts Department of Public Safety
Registry of Motor Vehicles
Massachusetts Port Authority
City of Boston

Meetings have been held in August and September, with additional meetings planned, towards the development of an effective campaign. Some of the measures planned thus far include: emergency phone numbers to receive reports on storm conditions for both the public and media, each agency would have it's own number; the use of handout materials, mail enclosures and public service announcements; meetings with members of the business community to discuss staggered release times during storms, this would also involve coordination with the Massachusetts Bay Transportation Authority to provide the needed service at off peak hours.

IX CITIES AND TOWNS

The Maintenance Section of the Massachusetts Department of Public Works in an effort to aid local Cities and Towns in reducing the use of deicing chemicals will conduct a series of seven separate but repetitive conference sessions throughout the State intended to discuss winter operational techniques with local municipalities. The following letter was sent to all Cities and Towns in the Commonwealth as well as to members of the Snow and Ice Control Task Force. The letter was sent to members of the Task Force in the hope that they may be able to persuade the appropriate local representatives to attend these sessions.



The Commonwealth of Massachusetts

Executive Office of Transportation and Construction

Department of Public Works

Office of the Commissioner

100 Ashua Street, Boston 02114

August 13, 1977

(This Letter Sent To All Mayors and Selectmen, Massachusetts)

Dear Sir:

In a continuing effort to cooperate with State and local officials concerned with the impact of roadway salting on our natural environment, I am authorizing the conduct of seven separate but repetitive conference sessions, this Fall, intended to discuss Winter operational techniques with municipalities. As Commissioner of the lead agency, I offer this opportunity for constructive exchange between specialists of this Department and those of your supervisory personnel involved in snow and ice control. The direct advantage to you can be equally economical as well as generally ecological.

Attached herewith is a list of the locations and dates for the sessions, all of which will provide the same coverage allowing your personnel to select the one most convenient to their time and travel. Each will begin promptly at 9:00 A.M. and end prior to 12:30 P.M. I can assure you that the subject matter will be of prime interest; the first half of each session will be on the most effective use of chemicals and the latest advances in operational techniques; the second half will be equipment, its efficient usage, preventive maintenance and recent functional improvements. Respectively, the two moderators will be Francis H. Carr, Jr., our Snow and Ice Control Engineer, and John J. Sullivan, our Superintendent of Shop and Equipment. Informational exchange will be oriented to municipal needs. However, we have developed certain field experiences, conducted some chemical experimentation and evaluated particular equipment improvements which are adaptable to the requisites of City and Town forces.

The attendance we seek from your municipality would be primarily three in number; the Principal in charge of your public works organization, the assistant specifically charged with snow and ice control and the person responsible for the maintenance, repair and replacement of your equipment. You may send others associated with the activities but, please, bear in mind in each instance, accommodations are somewhat limited.

The attendance is understandably optional, but I would urge the participation of your officials at one of these brief sessions, not only for what we may impart helpfully, but also for those beneficial experiences which may be exchanged among the attendees. We have a common responsibility in the judicious use of de-icing salts to meet our roadway needs and a common obligation to achieve minimal usage to lessen environmental impact. I know you share this important concern and seek, as we do, realistic measures which will satisfy both sides in this issue. Cooperatively we can achieve this end.

Let me again urge that you afford the attendance of the personnel indicated for an equitable advance in this mutual problem.

Very truly yours,

JOHN J. CARROLL
COMMISSIONER

LOCATIONS & DATES OF SESSIONS

All Sessions 9:00 A.M. (Promptly please) to 12:30 P.M. - 1977

- September 20th - Worcester: Amphitheater #2, University of Mass. Medical School, Plantation St. - $\frac{1}{4}$ mile west of Lake Quinsigamond Bridge.
- September 21st - Holyoke: Auditorium, Soldiers' Home in Holyoke, Route 91 west side Exit #16.
- September 22nd - Fitchfield: Auditorium, Western Mass. Electric Company West Street, west bound - $\frac{1}{2}$ mile out of Park Square.
- September 27th - Concord: Auditorium, Sentry Insurance Co., Route #2 west bound side, opposite Emerson Hospital at Nine Acre Corner Road.
- September 28th - Danvers: Auditorium, Danvers State Hospital, Route 62, West bound, 0.1 mile from the Junction of Route 1.
- September 29th - Easton: Auditorium, South Eastern Regional Vocational Technical High School, Route 106, south side, 0.6 miles west of Route 138.
- October 4th - Wareham: Auditorium, Wareham Town Hall, Route 6 east bound side - $\frac{1}{2}$ mile west of Wareham Center.

X. COMMENTS ON DRAFT E.I.R. AND RESPONSES

As required by paragraph 7.6 of the Rules and Regulations for the Preparation of Environmental Impact of the Executive Office of Transportation and Construction, this section contains all comments received from State agencies and the Secretary of Environmental Affairs and indicates in the margin in which section of this report the response to such comments may be found. If a response is not contained in the text itself, there will be reference to a particular response. These responses will be found at the end of this section.

A summary of comments received from the general public and non-State agencies and organizations is also contained in this section. As is the case for comments from the Secretary of Environmental Affairs and State agencies the responses for most of these comments is contained in this Final Environmental Impact Report. A copy of the letters of comment received from the general public and non-State agencies and organizations may be reviewed in their entirety at the Environmental Section of the Massachusetts Department of Public Works, 100 Nashua Street, Boston, Massachusetts.

X. COMMENTS ON DRAFT E.I.R. AND RESPONSES

SUMMARY OF COMMENTS

Mrs. Helen Sweeney, Brimfield, MA.

Disagrees with phrase "salt-maintained high level of service policy". Doesn't feel that the level of service in her area can be considered a high level of service.

Richard B. Southworth, Winchester, MA.

Neither benefits nor costs are understood clearly enough to formulate a long term policy.

No estimates of costs due to contamination of ground water or damage vegetation.

The effects of salting upon highway safety are indeterminate.

Alternatives 2 and 3 include salt use in ice storms and freezing rain (p. 208, 209) however, on p. 242, 243, and table V-1, V-2, and V1-1 salt use was not included in evaluating these alternatives.

It is probable that the "selective level of service" would result in only minimal reduction in the amount of salt used.

Keith J. Harrison, W. Falmouth, MA.

Content of the report, on the whole, appeared to be thorough and objective; however, some sections seemed to be skimpy and apologetic.

In some instances there was a lack of facts and/or figures to back up statements.

Various editorial comments for incorrect wording, spelling and capitalization.

Non-chemical selective level of service is not discussed sufficiently.

The discussion of early plowing deserves more coverage and analysis.

X. COMMENTS ON DRAFT E.I.R. AND RESPONSES

SUMMARY OF COMMENTS

Keith J. Harrison, W. Falmouth, MA. (Cont'd)

Doesn't agree with; the use of the term "do nothing"; the operator making the decision to "blast" trouble spots; plowing snow on bridges over water over the side.

Agrees with; monitoring policy as discussed on page 39; elimination of "panic factor".

SRPEDD

Although most concerns were addressed in the draft, there should have been a more complete cost-benefit analysis for all alternatives, so that the most cost effective policy could be determined.

Environmentally sensitive areas should be identified and a policy implemented to reduce or eliminate the use of salt in these areas.

Nolan Jones, Winchester, MA.

The report is seriously deficient in the area of contamination of water supplies.

The automobile depreciation figures, as a result of road salting, are too low.

There should be a citizen advisory board which would have directive authority.

Can't recommend acceptance of draft report.

David Stickel, Holyoke Community College

Report should contain snow and ice control data on non-state jurisdictional activities.

Negative social impacts of the salt-maintained high level of service policy should be discussed.

Doesn't agree with definition of "do nothing alternative".

X. COMMENTS ON DRAFT E.I.R. AND RESPONSES

SUMMARY OF COMMENTS

David Stickel, Holyoke Community College, (Cont'd)

In some instances there was a lack of facts and/or figures to back up statements. If no backup data statements should be stricken.

Environmentally sensitive areas should be identified and a policy implemented to minimize or eliminate the use of salt in these areas.

The practice of channelling drainage away from one area and directing it into another should be reconsidered.

Appendix X, Vegetation Salt Tolerance Tables, should have been included in the report.

A winter tire policy should have been discussed.

The report is a compilation of raw data much of it repetitious and unimportant.

The report should have made policy recommendations; however, it didn't and therefore, is inadequate.

Lake Cochituate Watershed Association

The report gives the general implication that nothing significant can or will be done to deal with the environmental and economic problems associated with road salting.

The Massachusetts Department of Public Works should; expand efforts to reduce salt use; launch public information campaign to change driving habits in bad weather conditions; expand experimental salt-reduction program near sensitive environmental areas.

The Executive Office of Environmental Affairs should; identify staff for regular attendance at agency meetings concerning snow and ice control; encourage workshops dealing with snow and ice control; establish maximum drinking water standard of 20 ppm; identify snow and ice control practices as a serious environmental issue which must be addressed immediately.

X. COMMENTS ON DRAFT E.I.R. AND RESPONSES

SUMMARY OF COMMENTS

Conservation Law Foundation

The report is deficient in the discussion of the impacts of road salting upon the environment, particularly ground water supplies.

Data for sodium contamination of wells does not take into consideration private wells and therefore, doesn't reflect the true ground water pollution problem.

Measures that will be taken to minimize damage to the environment are not presented and therefore, the requirements of Chapter 30, Section 62 have not been met.

The short and long term environmental consequences of salting are not described.

Alternatives to the present policy are not adequate and don't address requirements of Chapter 30, Section 61.

Is Chapter 81, Section 19 being correctly interpreted?

Habitat

Commends MDPW on the research that went into preparation of report.

Elimination of the "panic factor" is a big step towards reduced salt usage.

Advocates salting policy which minimizes impacts upon the environment and provides safe and reasonably clear highways.

Massachusetts Audubon Society

Can't recommend acceptance of the draft report because it is seriously deficient in some areas.

Report seems to be a justification of the present winter maintenance policy.

X. COMMENTS ON DRAFT E.I.R. AND RESPONSES

SUMMARY OF COMMENTS

Massachusetts Audubon Society, (Cont'd)

Inadequate cost-benefit analysis.

The report doesn't discuss methods to eliminate or minimize water supply contamination.

Recommend the non-chemical high level of service alternative be implemented within the next five years.

Massachusetts Forest and Park Association

Recommends rejection of the report because it doesn't propose measures to minimize water supply contamination.

No relationship between highway safety and snow and ice control practices has been established.

The selective salt use alternative should be implemented.

MDPW interpretation of Chapter 81, Section 19 is questionable.

Sierra Club

Inadequate treatment of the environmental impacts of the present snow and ice control practices.

No discussion of the measures to be used to minimize impacts upon water supplies.

Some of the alternatives to the present policy were not analyzed sufficiently.

City of Cambridge, Conservation Commission

Recommend designation of critical watershed areas and the use of specific snow and ice control practices to eliminate or minimize environmental damages.

Support the purchase of new equipment and better training of personnel.

MDPW should experiment with different salt spreading techniques.

X. COMMENTS ON DRAFT E.I.R. AND RESPONSES

SUMMARY OF COMMENTS

City of Cambridge, Conservation Commission, (Cont'd)

Extremely concerned with the use of salt on Routes 128 and 2 which are adjacent to the city's Hobbs Brook and Stoney Brook reservoirs.

Old Colony Planning Council

MDPW should be commended for improving its management practices at the chemical storage sites.

Salt reduction tests should be continued.

Some statements are made in the report without sufficient backup data.

Cost-benefit analysis for present policy should be included.

A greater effort should be made to involve citizens in the decision making process.

Recommends that application rates be established at the District level rather than on a statewide basis.

Merrimack Valley Planning Commission

Environmental impacts of vendor sites should be documented.

Inadequate coverage of environmental impacts on vegetation.

More cross referencing in the report would be useful.

Stephen Kaiser

Report is a major improvement over the December, 1974 report.

Neither the full advantages or disadvantages of snow and ice control practices are discussed.

Appears to be a sense of defensiveness in the report.

Because of the length and detail of Mr. Kaiser's comments no further summation will be made.

X. COMMENTS ON DRAFT E.I.R. AND RESPONSES

SUMMARY OF COMMENTS

Metropolitan Area Planning Council

The report should have investigated, in more detail, the impacts of the present snow and ice control policy.

Where conclusions are made, seems to be a lack of sufficient backup data.



EVELYN F. MURPHY
SECRETARY

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs

300 Cambridge Street

Boston, Massachusetts 02202

October 29, 1976

Commissioner John Carroll
Department of Public Works
100 Nashua Street
Boston, Massachusetts

Dear Commissioner Carroll:

This is in response to the revised draft environmental impact report on Snow and Ice Control (EOEA #02353) submitted by the Department on July 15, 1976. It is clear to me after almost two-years of review, revisions and further impact studies in this area, that principal attention must now be directed towards immediate and significant policy changes. The evident adverse environmental consequences of the present policy, described by the Department as "salt-maintained high level of service", together with the limited and questionable safety benefits which such a policy provides, point to the need for a new policy. I believe that major reductions in salt use can be instituted now without jeopardizing the level of service necessary to sustain the economy's requirement for a smooth flow of goods and services.

Therefore, I have determined that the following policy steps should now be instituted:

III B.3

1. The Department of Environmental Quality Engineering (DEQE) shall, with the advice and consent of the Department of Public Health, adopt after public hearing a sodium (Na+) standard for safe drinking water in Massachusetts.

2. Pending the formal adoption of a sodium standard, the DEQE shall propose an interim advisory standard.

III B.3

3. The DEQE shall identify major, important water sources where present water quality seriously exceeds the interim sodium standard.

4. Upon adoption of a formal sodium standard, DEQE shall identify all public water sources which exceed the standard.

III B.3

VI

5. The Department of Public Works shall, upon being advised by the DEQE of the water sources identified in step 3, take all feasible means immediately to institute a low-salt selective level of service policy on stretches of state highways where salt application might adversely affect water quality of such sources.

6. The DPW shall begin planning so as to be able in the future winter seasons to implement a low-salt selective level of service policy in all areas identified by the DEQE in step 4.

111 B.3
IV
VI

7. For all other areas, the policy which you presented to me in our recent meeting is acceptable. This policy focuses on reducing by 20 percent the total amount of salt applied per lane mile over the entire winter taking into account the relative severity of storm conditions. This is a more meaningful measurement of relative use of salt. This new policy will mean, for example, that if winter 1976-77 is of comparable severity to winter 1975-76, the amount of salt applied per lane mile will be reduced to 11 tons from 13.75 tons. Expressed as an application rate the reduction would mean a new application rate of about 240 pounds per lane mile in comparison with last season's announced application rate of 300 pounds per lane mile.

111 B.1

8. All other state agencies and authorities shall also initiate salt use programs designed to accomplish the 11 ton per lane mile total usage rate for a winter of comparable severity to winter 1975-76.

111 B.1

9. My office, with the assistance of the Office of Communities and Development will initiate an educational effort to advise and assist cities and towns in achieving reductions in salt usage comparable to those achieved by the Department of Public Works.

IX

These policy changes represent a continued effort towards the goal we announced last year of achieving a salt use policy which minimizes adverse consequences of salting while maintaining adequate levels of service and safe highways.

The draft report which you submitted has supplied a substantial amount of data and analysis and has been of assistance to me in formulating the policy steps which I have just announced. As such the draft report has adequately and properly complied with the basic requirements of G.L. ch. 30, s. 62, for a draft report on a major program.

All who have spent the time and energy necessary to explore the issues of salt for snow and ice control recognize the complexities which policy formation in this area present. The draft report was a substantial improvement over the earlier version. It represented an intelligent and significant effort to present the complexities and conflicting costs and benefits of both the previous policy and alternatives. While I regret the length of time which its preparation required, the Department is to be commended for the effort.

The task is now to institute the policy while preparing expeditiously a final report which can serve as the basis for refinement and adjustment to that policy in the light of additional data and analysis. The final report should concentrate on the following areas:

1. Measures to be used in areas of high sensitivity to salt use for drinking water supply purposes - essentially those areas identified by the DEQE. Here future policy should move aggressively towards a low-or no-salt selective level of service. Low salt to be used in areas where a high level of service is vital. No salt for areas where a moderate level of service will be adequate for economic purposes.

111 B.3
VI

Commissioner Carroll
October 29, 1976
Page 3.

III 8.3
VI
2. Measures to be used in areas where salt impacts on water supply would be minimal, but where salt use might have significant adverse consequences for road and bridge maintenance. Here a salt maintained high level of service policy may be appropriate with continuing effort to monitor and regulate the amount of salt so that total use is minimized.

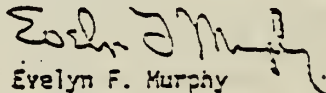
IV
3. Establishment of a long-term program of equipment upgrading and personnel training. In this regard the recent efforts of the Department are particularly to be commended. This program should set forth the budgetary needs over a three or four year period required to carry out effectively the policy measures arrived at.

V
4. Identification of areas where continuing research and development effort is needed further to refine policy; for example, experimentation with porous pavement. In this regard, new segments of highway designed for construction in the next several years offer opportunities for testing not presented by overlays on existing surfaces.

The final report should be based on the premise that different areas of the state present different problems for snow and ice control and for salt use in that policy. Some areas are more sensitive to salt impacts, some areas present higher demands for levels of service. If the final report takes these differences into account and responds to the guidelines and policy standards presented here, I expect it will be a highly useful tool in reaching our mutual goal. I hope that it will be ready early in 1977 so that it can more effectively assist in refining policy for winter 1977-78.

One final comment is in order. Notwithstanding the difficulties and occasional adverse comments which the Department has faced in the process of preparing the draft report, I recognize and appreciate a real sense of commitment and cooperation in the Department to make its snow and ice control program responsive to the environmental, social, and economic needs of the Commonwealth. While the Department is not the only user of salt for snow and ice control, it is in the public mind the agency which is looked to for leadership in this area. I believe that leadership is being and will continue to be provided. I look forward to future work with you in this area and pledge my cooperation and assistance whenever needed.

Sincerely,


Evelyn F. Murphy
Secretary

EFM/RRH/ddn

cc: Michael S. Dukakis, Governor
Attorney General Bellotti
Secretary Salvucci, Executive Office of Transportation and Construction
Commissioner David Standley, Department of Environmental Quality Engineering
Commissioner Fielding, Department of Public Health
Commissioner Snedeker, Metropolitan District Commission
Director Kiley, MSTA
Director Driscoll, MTA

Public comments received on Draft Report.



The Commonwealth of Massachusetts

Executive Office of Environmental Affairs

100 Cambridge Street

Boston, Massachusetts 02202

COASTAL ZONE
MANAGEMENT

RECEIVED

SEP 18 1976

MEMORANDUM

OFFICE OF THE SECRETARY OF
ENVIRONMENTAL AFFAIRS

TO: Ray Ghalardi

FROM: Sharon Alexander ^{ALA} and Lester B. Smith, Jr., Coastal Review Center

DATE: September 9, 1976

SUBJECT: Draft E.I.R., Snow and Ice Control, M.E.P.A. # 02353.
State Clearinghouse # 76070872

This Office has reviewed the draft E.I.R. for Snow and Ice Control. On page 233 the report indicates that salt used for dealing with winter ice and snow conditions has been "the probable major cause of salt contamination of water supplies". It also states, page 232, that the rate of contamination has been increasing which is very important since the water supply is barely adequate to meet the present demands in eastern Massachusetts. Several towns (Auburn, Goshen, Weston and Burlington) have had to temporarily or permanently close their water supplies because of contamination. Many other instances of groundwater or public water supply contamination are cited indicating that the salt contamination problem is becoming a major problem. Since salt contamination is cumulative, it can only get worse as salt use continues. Therefore, steps must be taken immediately to reduce salt use to avoid imminent problems to water supply.

According to the draft E.I.R., environmentally sensitive areas to salt applications have not been identified. In the final E.I.R. these areas should be identified and a program of snow and ice control which minimizes salt use should be promulgated for them.

111 B.3
VI

One area where a great danger exists if the ground water aquifer is polluted is on Cape Cod, since no other fresh water is available. On page 277 of the draft E.I.R., the provisions listed for counterbalancing the impact of contaminated waters were replacement of water supplies to towns, use of high quality bottled water and treatment by desalinization. Since the entire Cape Cod area depends on the groundwater aquifer and is thus entirely subject to salt contamination, replacement does not appear to be a feasible alternative, nor does desalinization, which is very expensive. Bottled water may be helpful for persons on sodium restricted diets, but magnitudes of water required to supply other needs make this alternative for the Cape untenable.

The practice of road salting has been justified in the past for its value in increasing safety conditions. However, the draft F.I.R. seems to indicate that the practice of salting roads to remove snow and ice has no appreciable positive impact on the accident rate. Indeed, the effect seems to be rather to increase the number and speed of vehicles on the road, a situation which leads to more danger of accident involving injury since there are still hidden patches of ice lying in wait for unwary drivers traversing salted roads i.e. salting instills a false sense of security.

VII Arguments made in the draft F.I.R. regarding economic loss due to reduced mobility are, it appears to this Office, open to question. In discussing cost-benefit analysis of salt use on page 11, the draft F.I.R. states that if cost-benefit analysis were implemented now, it is uncertain whether it would result in a net gain to society. This statement definitely implies the need for cost-benefit analysis and probably the need for scaling down the use of salt to the extent that it equals the accrued benefits to society.

VII Thus, it would seem to this Office, that the practice of road salting creates more problems than it solves and should thus be severely curtailed, except on roads which are deemed absolutely necessary for the mobility of emergency service vehicles.

VIII The Public Education section of the draft F.I.R. which deals with informing the public of benefits which could result from reduced salt usage should be expanded. The public should be made aware of the many potential problems continued salt use will bring.

VII This report on Snow and Ice Control appears to have been written primarily to discuss the impacts of reduced road salting practices, though alternative methods of snow and ice control are examined cursorily. We note some deficiencies in this discussion including:

- the positive impacts of non-salt methods of road clearing, such as benefits to the economy in labor employment, and,
- the positive impacts of not plowing at all, (i.e. the reduction of some of the negative impacts which are the result of plowing) such as:
 - 1) the increased usability of curbside parking spaces which would occur if snow were not plowed up against the curb; plus the attendant reduction in street congestion problems which presently occur when cars must park several feet from the curb;
 - 2) the reduction of inconvenience caused by the burial or blockage by plowed snow of cars parked at curbside;
 - 3) the increased ability of the snow to melt evenly rather than to turn it into the unsightly, unmanageable mounds of ice at the side of the road with which we presently contend.

MEMORANDUM

Subject: DFW-DEIR
No. 2358 - Snow and
Ice Control Programs

To: Dick Bates

From: Herb Padman *H.P.R.*

Date: August 26, 1976

The Division of Air Quality Control has reviewed the subject Draft EIR.
The following comments are herein submitted:

- 1) The DEIR contains much information that is repetitive, and unnecessary filler.
- 2) There is insufficient data presented to conduct any review of air quality impact. It appears to be a deceptive device on the part of MDPW to submit an EIR such as this and drag it out until the winter season has come and gone, - again, without an adequate submittal.
- 3) One of the reasons more air quality data must be supplied is expressed in the attached memo from Ed Benoit, the District Director for the Central Massachusetts Air Pollution Control District.
- 4) Not sufficiently covered in this analysis is the remaining 2/3 (approx.) miles of roads in the state that are controlled by the cities and towns. Unless this can be addressed, the futility of this EIR is understandable.

RESPONSE

1

RESPONSE

2

jm

cc: Neil O'Leary
Ed Benoit
Bob Donovan
John Desmond
Steve Joyce
Bruce Maillet
Bill Cass
DAQC

MEMORANDUM

SUBJECT: Mass. DPW Draft EIR-
Snow and Ice Control
Program
EOEA No: 02358

TO: Herb Redman
FROM: Ed Benoit
DATE: August 17, 1976

As you are aware the City of Worcester is a primary and secondary standard violation area for Total Suspended Particulation.

Furthermore, intensive investigation and analysis have led to the conclusions that winter road maintenance of streets and subsequent sand entrainment is the single largest remaining source of particulate contributing to this problem.

A Task Force comprised of appropriate agencies within the City and the DAQC has been established for the purpose of evaluating existing road maintenance practices and what alternatives could be implemented to aid in reducing sand entrainment.

In addition to the City DPW activities, the other major source of potential sand entrainment is the State DPW road responsibilities in the City, particularly the Worcester section of I-290. The Worcester portion of this road is an elevated highway of some 7 miles in length, with 6 road lanes and several on-off ramps. The highway is within the basin of the City where the highest TSP levels are recorded. Due to its location, its elevation, size (6 travel lanes), high traffic volume, and high speed (55 mph), the potential for sand entrainment and subsequent impact in the community is strong.

Furthermore, if the City is expected by the State through this Department to implement winter road maintenance practices that more than likely will be more costly than present practices, it is incumbent of the State to assure that its own practices are consistent with best available technology. In fact, the City would have a valid point in objecting to expensive alternatives if the State has not made corrections to improve their contribution to sand entrainment.

With the above as background, it becomes obvious that the following questions need to be addressed in any EIR by the State DPW:

RESPONSE
3

1. How many roads in Worcester, including length, lane miles, and location are maintained by the DPW?
- 111 B.1 2. What type of control is employed on each segment (salt, sand, or combination) including all on-off or service lanes associated with these roads?
- 111 B.1 3. What is the total sand and salt usage for each road in 1975 and is that characteristic of annual usage for these roads?

RESPONSE 4. What clean-up practices are employed and how often?

A

5. What alternate practices could be employed to reduce sand deposition and increase frequency of clean-up after each storm?

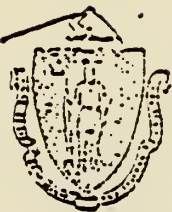
It would perhaps be prudent for the DAQC to establish a program with the State DPW similar to the Task Force with the City to determine what can be done by the State.

As I stated earlier, it is imperative that the Commonwealth demonstrate its intentions to abate its own sources of emission if it expects the City of Worcester to do the same.

If you wish further information concerning that investigation and conclusions on the City TSP problems, please see Bill Cass who is quite familiar with the situation.

EGB:mlk

CC: Bill Cass



The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Management
Lowell Posenstall Building, Government Center
100 Cambridge Street, Boston 02202

DR. BETTE WOODY
 COMMISSIONER

September 21, 1976

Mr. Robert J. Tierney, P. E.
 Chief Engineer, Dept. of Public Works
 100 Nashua Street
 Boston, Massachusetts 02114

Dear Mr. Tierney:

1. The following comments are made relative to the Draft Environmental Impact Report for the Snow and Ice Control Program.

2. The 1976 draft E.I.R. covers a much wider range of the subject and provides greater comprehensive treatment than was evidenced in the report prepared in the past.

3. This report shows evidence of the hard work expended and the expertise offered by members of the Task Force assembled by the DEP and others involved in similar snow and ice control programs. I am pleased that this Department was called upon to participate, and I trust our contribution was helpful. However, because of our participation, the comments being given may not be as objective as some being given from other sources who may be reading the E.I.R. for the first time and are not aware of earlier drafts, the polling of opinions, the acceptances of professional experiences, and the revisions considered necessary to reflect the documentary evidence and facts brought out by research and a series of conferences.

4. It might be assumed by some that the report is biased to justify past snow and ice control practices and thus maintain a status quo in that regard. It is the feeling here that point of view is not reflected in the documentation, nor in the written text. It is my understanding a determined effort was made to avoid that assumption and to let the facts speak for themselves.

5. It is pleasing to note that storage areas have been and still are being upgraded. It is equally pleasing to note that state equipment and hired equipment used in snow and ice control also is being upgraded in efficiency.

6. The report appears quite candid in discussing intrusion of salt into the water environment and the effect such action may have on health. An improvement at this point might be the addition of steps that will be taken to contain or control such intrusion in areas of significantly potential dangers. Additionally, possible alternatives to current practices in the "danger areas" might be expanded upon.

III B.3

VI

7. The effect of the snow and ice control program on the safety and health of mankind is covered in some depth. Comparatively little is included which deals with preventing, controlling, or minimizing damage to the environment. The latter issue should be expanded in a later E.I.S.

III B.3

VI

8. It is significant that DFW embarked on an experimental test program in various parts of the Commonwealth this past winter. It is also significant that essentially the same general conclusions became apparent after a review of collected data in all districts involved. These tests, professionally administered, and the before and after information meetings in areas tested, is partial evidence of DFW's efforts to get communities and citizens to be aware, to become involved, and to have a hand in future practices.

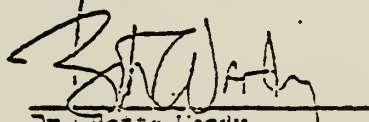
9. It is realized that travelled ways for which the Department of Public Works, Metropolitan District Commission, Massachusetts Bay Transit Authority and Massachusetts Turnpike Authority are responsible, represent only a portion of the areas where salt is used, but it seems that the E.I.S. might be enhanced somewhat if there was more reference to snow and ice control measures utilized by cities and towns and other users of salt -- and what measures DFW is employing to aid, assist and educate local communities in modern, safe and efficient means of snow and ice control.

VIII

IX

10. Authors of the E.I.S. deserve commendation for producing a document which, although some will disagree with a portion of the assumptions, provides a readable and informative portrayal of a type of highway maintenance in which only a relatively small segment of the population is aware of the basics.

Sincerely yours,


Dr. Bette Keedy
Commissioner

BW:ECN:sj



THE COMMONWEALTH OF MASSACHUSETTS

OFFICE OF STATE PLANNING
JOHN W. MCCORMACK BUILDING ROOM 2101
ONE ASHBURTON PLACE
BOSTON, MASSACHUSETTS 02108
(617) 727-5066

MICHAEL S. DUKAKIS
GOVERNOR

FRANK T. KEEFE
DIRECTOR

August 17, 1976

Secretary Evelyn T. Murphy
Executive Office of Environmental Affairs
100 Cambridge St.
Boston, MA

attn: MEPA unit

Re: A-95 Review of Draft EIR on Snow and Ice Control Program
State Clearinghouse Identifier: 76070872
EOEA Number: 02358

Dear Secretary Murphy:

The Office of State Planning has completed its review of the Draft Environmental Impact Report on the Snow and Ice Control Program.

We find the EIR to be adequate in its assessment of the environmental impacts resulting from the proposed activities.

Sincerely,

FRANK T. KEEFE
Director of State Planning

cc: Attorney General Ballotini
John J. Carroll, DPW

RECEIVED

AUG 20 1976

OFFICE OF THE SECRETARY OF
ENVIRONMENTAL AFFAIRS



The Commonwealth of Massachusetts

Division of Fisheries and Game Wildlife

Lowell Sollenstall Building, Government Center

100 Cambridge Street, Boston 02302

RECEIVED

August 5, 1976

OFFICE OF THE SECRETARY OF
ENVIRONMENTAL AFFAIRS

Secretary Evelyn F. Murphy
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts 02202

Attention: MEPA Unit

Dear Secretary Murphy:

This agency has reviewed the "Draft Environmental Impact Report for the Massachusetts Snow and Ice Control Program", June 1976 and concurs with the statements and discussions pertaining to fish and wildlife. Our experience and research of the literature indicates that there are no known significant adverse effects on resident fish and wildlife associated with highway salting in Massachusetts. Unless subsequent research uncovers evidence to the contrary, we would agree that Massachusetts fish and wildlife would be relatively unaffected by either a salt or no-salt policy for snow and ice control.

Yours sincerely

Ce- H. B. J.

Colton H. Bridges
Director

CHB/PSM:cms

cc: Commissioner John J. Carroll, DFW

THE COMMONWEALTH OF MASSACHUSETTS

02358

INTER OFFICE CORRESPONDENCE

DEPARTMENT OF ENVIRONMENTAL
QUALITY ENGINEERING

From P.L. Anderson.....

Attention of R. Bates.....

Subject Draft EIR (EOEA No. 02358)

Snow + Ice Control Program, etc.

26 August 1976

Subject draft has been reviewed.
We have no comments regarding draft
content and the areas of concern
of this Division.

DEPT. OF ENVIRONMENTAL QUALITY ENGINEERING
DIVISION OF PLANNING
100 CAMBRIDGE ST., 20TH FLOOR
BOSTON, MASSACHUSETTS 02102

Revised: 8-31-76
gme

MEMORANDUM

RECEIVED

SEP 23 1976

OFFICE OF THE SECRETARY
OF ENVIRONMENTAL AFFAIRS

TO: RICHARD BATES
PLANNING OFFICE
FROM: PAUL WATSON
DIV. OF WATER SUPPLY
DATE: AUGUST 18, 1976

SUBJECT: DRAFT EIR - SNOW & ICE CONTROL PROGRAM
EOEA NO. 02358

AS A RESULT OF A REVIEW OF THE NOTED
EIR, WE FEEL THAT THE POTENTIAL
IMPACTS OF THE PROGRAM ON SOURCES OF
PUBLIC WATER SUPPLY ARE ADEQUATELY STATED
AND THAT THE DISCUSSION OF ALTERNATIVES
AND METHODS OF REDUCING IMPACTS WAS
ALSO AS INCLUSIVE AS POSSIBLE CONSIDERING
THE STATE OF THE ART.

YOUR MEMO OF JULY 30, 1976
PRESENTS THREE QUESTIONS TO WHICH
WE REPLY IN THE AFFIRMATIVE.



C-6970

The Commonwealth of Massachusetts

Executive Office of Public Safety

Office of the Secretary

905 Commonwealth Avenue

Boston, Massachusetts 02215

Charles V. Barry
Secretary of Public Safety

DEPARTMENT OF PUBLIC WORKS
OFFICE OF THE COMMISSIONER

C O P Y

RECEIVED JUL 28 1975

MEMORANDUM

TO: Charles V. Barry, Secretary of Public Safety
FROM: John F. Kehoe, Commissioner, Department of Public Safety
RE: Draft Environmental Impact Report for Snow and Ice Control Programs - Department of Public Works

Secretary Barry:

We had representation in this report and I see no problem for us.

JFK

off
Guth
Cannell
OPW
LV

RESPONSE 1:

The Department of Public Works does not have the capabilities to conduct such an in-depth study. However, with the assistance of the Department of Environmental Quality Engineering it is hoped some future study of sand entrainment may be conducted.

RESPONSE 2:

This Environmental Impact Report covers only the miles of roadway maintained by the Massachusetts Department of Public Works, the Metropolitan District Commission, the Massachusetts Turnpike Authority and the Massachusetts Bay Transportation Authority.

RESPONSE 3:

The Department of Public Works maintains 14.09 miles of roadway in Worcester. This information is available for every city and town in the Commonwealth from the Department's Bureau of Transportation Planning and Development.

RESPONSE 4:

See page 49 of the Draft Environmental Impact Report for the Snow and Ice Control Programs.

